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OCTOBER 13, 1934

ELECTRICAL WORLD

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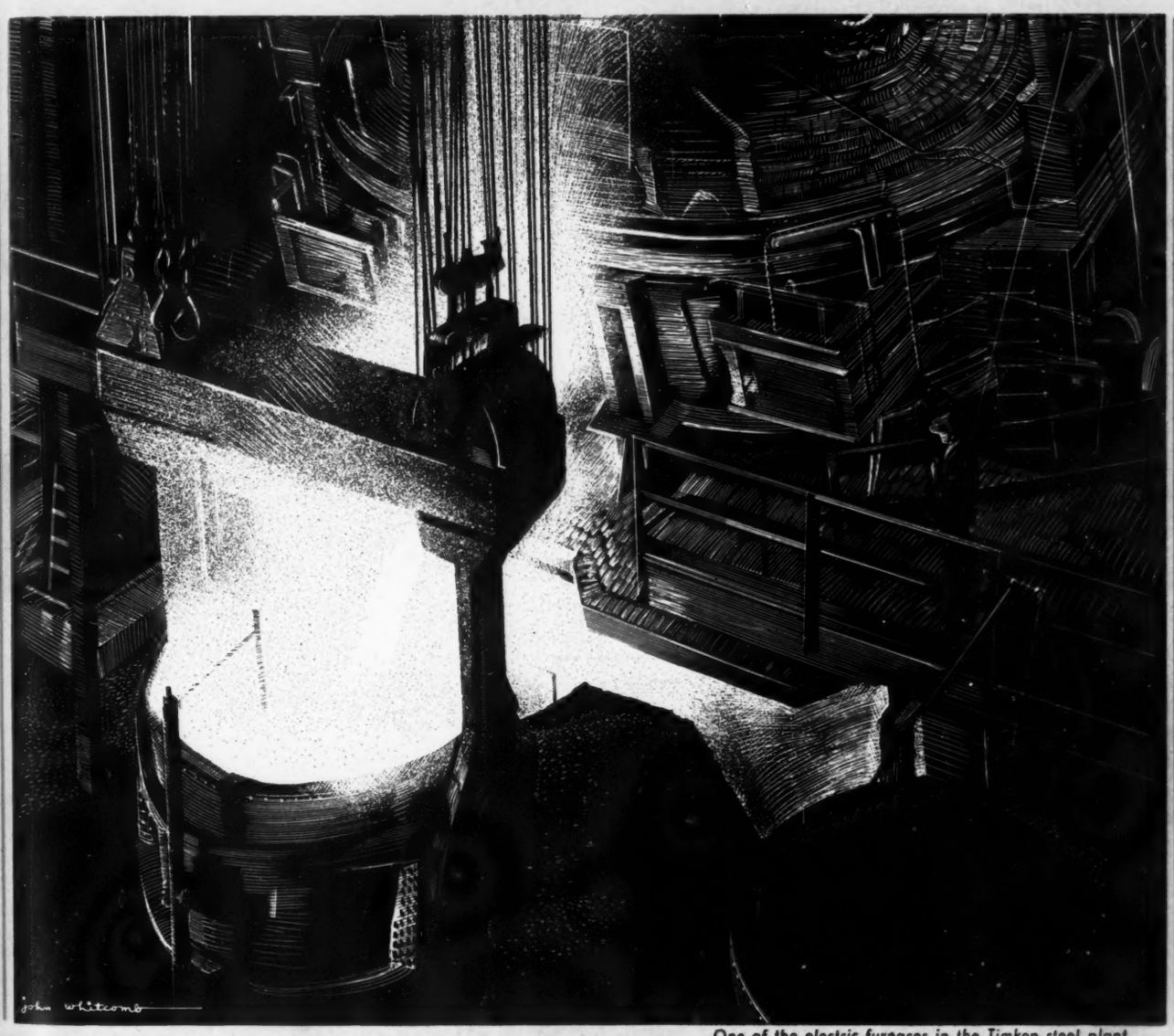

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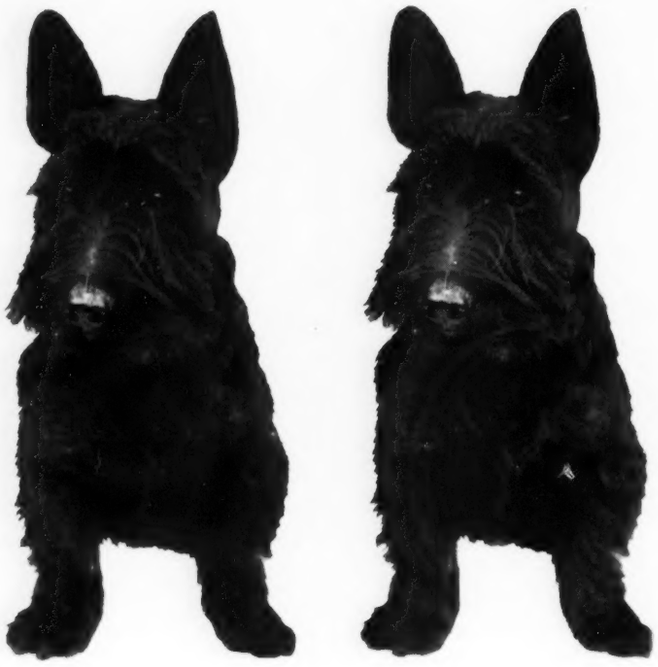

—meter seals look alike, too, but tests quickly prove the advantages of Murray Padlock Seals.

Look Alike - *but they're not alike*

Seal that LOOKS like the Murray (after test)—under the same force, wire gave way—and as it can be replaced—detection is *uncertain.*

Most meter superintendents are agreed that seals furnish protection against current diversion.

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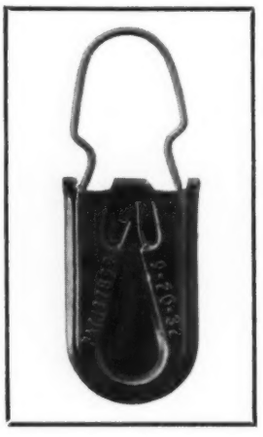

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ELECTRICAL WORLD

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THIS INDEX is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

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VOLUME 104 . . . NUMBER 12

Contents Copyrighted, 1934, by McGraw-Hill Publishing Company, Inc.

ELECTRICAL WORLD—Published every other Saturday. Price 25 cents a copy. Subscription rates: United States, Mexico, Central and South American countries, $4 a year; Canada, including duty, $5 a year; all other countries, $6, or 24 shillings, a year. Entered as second-class matter, January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.

Printed by The Schweinler Press, N. Y.

McGRAW-HILL PUBLISHING COMPANY, INC.

330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Chairman of the Board

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MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY OTHER SATURDAY

OCTOBER 13, 1934

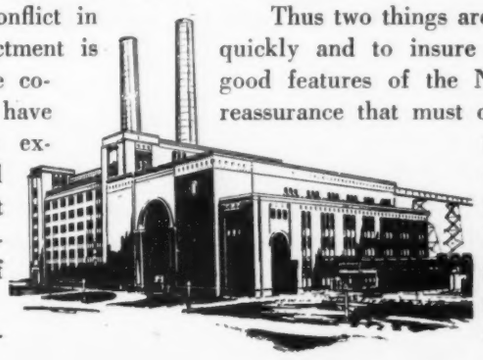
Business and the New Deal

FROM the dawn of history man has theorized about the ideal government. Plato and his Utopia have had numerous counterparts and many citizens now believe the new deal to be in this category of philosophical dreams. Public opinion is confused. For the new deal is in process of application and has not realized all the promises of its proponents. The final outcome is still uncertain, but the movement continues in full force.

It is advisable, therefore, that every citizen and every business take thought and action to support the good elements in the New Deal and to destroy the bad. And the only logical basis for doing this is to apply certain principles that have been established as sound through the experience of mankind over thousands of years.

The first of these is that the best government is a democracy and the chief principle of democracy is that the whole people shall decide public policies. A second principle is that a successful democratic government must be based upon laws and institutions and not upon men. And the third is that co-ordinated departments must be established to carry out the legislative, executive and judicial functions necessary to a successful democracy.

THESE principles are unchanging, but the statutes and forms devised for their detail applications can and should change. All grant that the industrial civilization developed in the past hundred years has created the necessity for many and even drastic changes in the minutiæ of democracy. But wherever the new deal conflicts with the basic principles it is a false beacon. And, unhappily, it does conflict in large measure. The chief indictment is that it is tending to destroy the co-ordination and the equality that have heretofore existed between the executive, legislative and judicial activities of the government. It is also tending toward a government of men instead of one of laws and institutions.

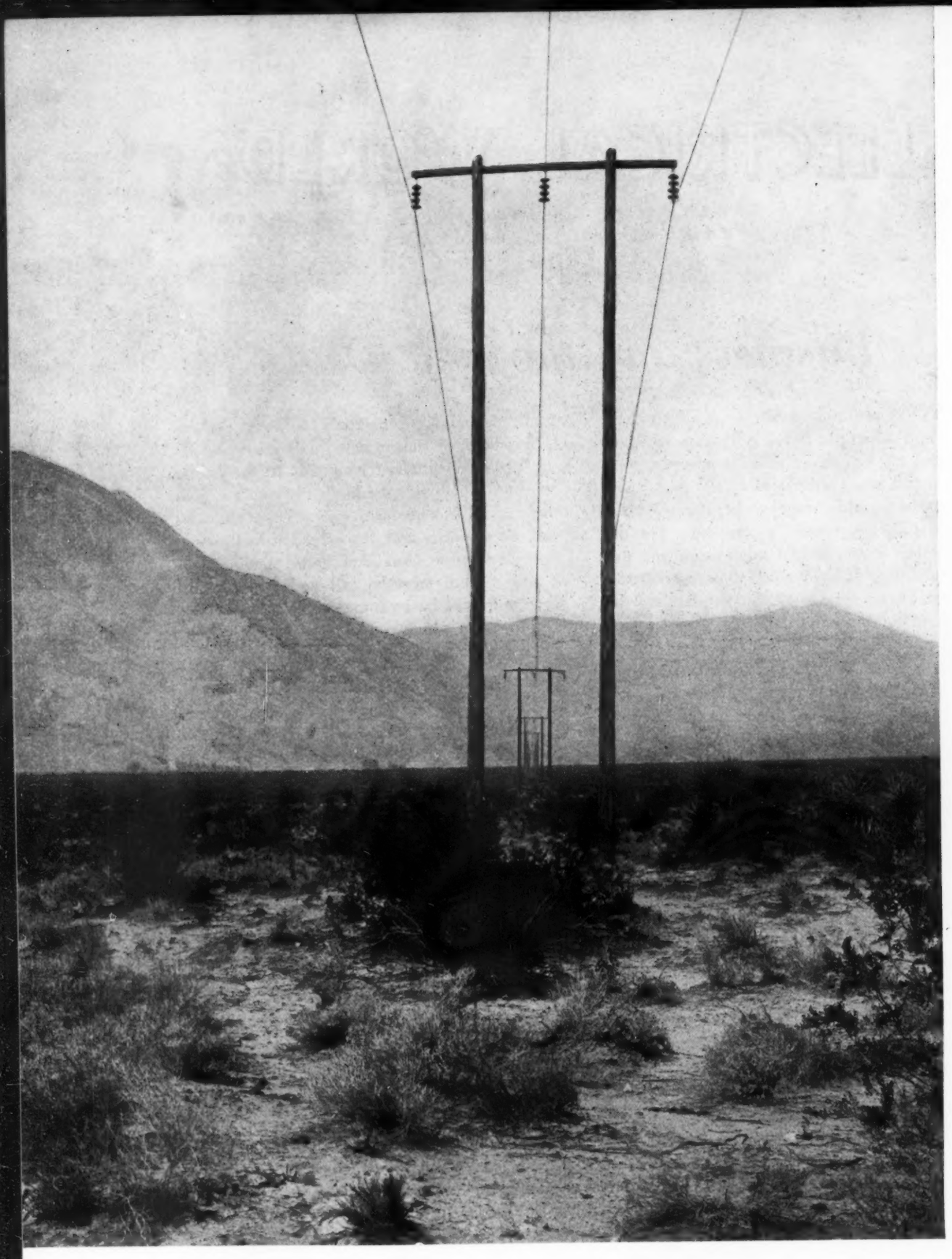


Also, so far as the new industrial civilization is concerned, the frame that enforces the principles of democracy must provide for certain essentials. There must be the utmost freedom of individual initiative consistent with the interdependence of society. There must be full use of power and of production facilities in order to lower costs and raise standards of living. There must be full and free play of the energies of business men so as to create new wealth, from which comes more buying power, more profit and more employment.

IT IS proved conclusively that there can be no sustained recovery until private capital goes back to work. The chief barrier to this at this time is the uncertainty which is feeding the fear of the future. This is the missing spark for business recovery. And this uncertainty could be removed very largely if the New Dealers would state their adherence to the fundamental principles and specifications that have been outlined. These are the clauses in the "bill of rights" that must be signed by the administration to restore confidence.

On the other hand, business leaders have the power to determine very largely whether this country is going to subscribe to some of the New Deal acts that violate the fundamental principles of democracy. They must solve the national unemployment problem. A well-fed man will support democracy; a starving man will support any false leadership that promises him food. Business itself must produce the economics of plenty so well outlined by Dr. Glenn Frank in his new book, "America's Hour of Decision."

Thus two things are needed to get recovery quickly and to insure public support of the good features of the New Deal. One is the reassurance that must come from the administration to give business confidence. The other is aggressive action by business to use its money, power, labor and machinery to produce wealth.



SOLELY FOR BUILDING LOS ANGELES AQUEDUCT

To construct the 240-mile aqueduct from Colorado to California a new 196-mile, 66-kv. line was built in preference to other sources of power. With a maximum distributed load of 18,000 kw. and 4,000 kw. to be delivered 300 miles, stability was a problem. The line cost ranged from $2,000 to $3,000 per mile.

The Trial-Rental Idea

The New Adventure in Selling to the Domestic Market. Important Factors in Setting Up a Local Program

By DAVIS M. DeBARD
Stone & Webster Service Corporation, New York, N. Y.

TWENTY-TWO years ago in Brockton, Mass., we had an interesting experience selling electric power to the shoe industry. The knowledge which we gained from this work was invaluable to us when we began the trial-rental program in our supervised properties, first for the promotion of gas water heating, and later for electric cooking and water heating.

At that time most of the shoe factories were operating their own plants. We were able to show them an opportunity for a saving in their power costs, but their managements were skeptical of our figures. Finally we offered to install complete equipment of motors and wiring on a rental basis for twelve months' trial, the customer was to pay the power bill and 15 per cent on the total cost of the installation at the rate of 1¼ per cent monthly. If our estimates proved out, and the manufacturer desired to continue the use of our service, we agreed to deduct 9 per cent of the 15 per cent he had paid as rental, leaving him to pay 6 per cent simple interest on the investment. If he was not satisfied we agreed to remove the installation and restore his original shafting and belts.

Twelve shoe factories were equipped on this basis during a period of five years and every one of them bought the installation. Today the local company has practically all the business in the shoe industry. This was our first experience in renting equipment and it set us thinking. Here, apparently, was a simple way to demonstrate to the customer the value of our service when he was not willing to invest on our assurance alone.

When we began the serious attack upon the problem of residential load building by the sale of small appliances, the first cost and initial installment were too small to make any rental offer necessary. Electric refrigeration met with such popular demand and was launched with such pressure from selling organizations, as well as adequate provision for installment financing, that the added inducement of a rental offer was not necessary. However, when we faced the problem of selling gas water heating and later electric cooking and water heating we ran into difficulty. We were selling so small a number of our customers by the ordinary methods that it would have taken 50 years to get any satisfactory degree of saturation. The problem which we had to overcome was not the original cost of the appliances, as they could be bought on easy terms, but the idea which the customer had in her mind that the service was expensive. The trial-rental plan was the most logical way to convince the customer that the service was cheap and invaluable.

In any discussion of trial-rental plans too much emphasis cannot be placed upon the difference between the trial-rental plan which we have in use on the supervised and constituent companies of Engineers Public Service and the rental plan which is in use in England and on the Continent. This difference is best brought out by a comparison of the aims of the two types of plans. The trial-rental plan is designed to *sell* the appliances, whereas the rental plan is designed solely to *rent* it. A trial-rental campaign is not complete without a follow-up sales campaign.

In 1933 the Stone & Webster Service Corporation took over the supervision of the 89 properties of the Consolidated Electric & Gas Company. We faced the necessity of an immediate development of residential load, both gas and electric, and we wanted quick returns. The only prompt solution offered was to move a large number of heavy-duty appliances into the homes of customers. In order to do this it was necessary in nearly every case to demonstrate the efficiency and economy of these appliances, so that the old prejudice against their high cost of operation could be overcome.

We decided to put these appliances out on a rental basis for a trial period. Before we began work on the trial-rental plan it was considered largely as a local phenomenon, hand-tailored for use in certain communities. We now believe, and we think that we have proved, that the trial-rental plan can be successfully used on a national scale. We are now using the trial-rental plan in some form or other in some 25 states and one foreign country.

As the first step in this work we secured the co-operation of a manufacturer of gas water heaters who offered to finance the local utility for a reasonable term of trial. We began in Indiana in August, 1933, and gradually extended the plan to the other properties under our supervision. We put out 20- and 30-gal. heaters for $1 down and $1 a month. The number rented out on trial was far beyond our expectations. It is the aim of our policy to follow up each trial-rental campaign in a reasonable period with a campaign to convert these installations into direct sales.

On the strength of our success with gas water heaters, we completed arrangements with four other manufacturers of electric ranges and water heaters to finance the rental of their

equipment on a 24 months' basis. It is interesting to note, however, that although this financing service was extended to them, a large percentage of the operating companies purchased the equipment for cash—2 per cent, ten days—and financed themselves.

Under this program we offer to install an electric range or water heater in the customer's home for a trial-rental charge ranging from $1.50 to $2 a month. The customer pays for the energy consumed at the regular rates, which range from 2 to 3 cents for cooking and about 1 cent for water heating. When the customer has had sufficient time to acquaint herself with the economy and value of the service, in many cases she will have become so dependent upon it that she would not do without it for many times the price. She is then approached to see whether she desires to purchase the equipment. If she decides to buy, the money she has paid in rentals is applied to the purchase price of the appliance, the balance may be paid in cash or on the usual installment terms with special discount for cash.

The response of our customers to the trial-rental offer of electric equipment was no less gratifying than the results of the gas water heating campaigns. To cite one case, the El Paso Electric Company, a constituent company of Engineers Public Service, has had six months' experience with the plan and has increased its unit saturation over 9 per cent. In the period from November 1, 1933, to April 30, 1934, it rented 1,425 ranges and water heaters. We had expected to connect about three ranges for every water heater, as we were in competition with natural gas, but we were surprised to find that we were connecting more water heaters than ranges. Rentals were more than seven times average yearly sales on a two-year installment plan.

The program established by this company is typical of the operation as we have followed it:

A charge of $1.75 per month is made for the range or the 50-gal. water heater and $1.50 per month for the 30-gal heater. For the range and 30-gal. heater the charge is $2.95 and the range and 50-gal. heater $3.20. These prices include installation. After 57 months' continuous use the rental ceases and ownership passes to the customer. The first three months' trial charge will be given free in exchange for the customer's old equipment.

Should the customer desire to purchase the equipment any time during the first 39 months of the contract, all payments will be credited on the purchase price. The sales price of the range or 50-gal. heater is $99.75, with a $15 trade-in allowance for old equipment and a 10 per cent discount on the balance for cash. In all cases the time price must be paid in not more than eighteen equal monthly payments. In no case will the total contract period exceed 57 months.

Service on this equipment will be maintained by the company during the life of the contract. If purchase is made during the first 45 months' period one year free service will be given from the date of purchase. In no case will the total free service period exceed 57 months.

Ranges and water heaters have been put out on a rental basis for years in many cities in England and on the Continent. American power companies are now taking up the idea and are using a rental offer as an approach to sales. Mr. DeBard has devoted much time to the development of this new technique in building domestic load and in this article reviews the methods that are being employed. He recently made a trip abroad studying European rental practices.

Any dealer who displays the trial range or water heater and who obtains an acceptable trial contract will be paid a commission of $10 on each appliance, payable in six monthly payments. Dealers who do not display this merchandise will receive a commission of $5 on each acceptable contract, payable in six monthly payments. The commission paid a dealer will be charged back against that dealer if the merchandise does not remain in continuous service for a period of six months, with six monthly payments made. Any dealer who turns in five acceptable contracts in any consecutive 60-day period is entitled to consigned merchandise for display. No consigned merchandise shall remain consigned longer than 60 days.

Installation work is divided equitably among contractors.

It is essential in any trial-rental program that the credit department must co-operate vigorously with the sales force in order to insure the success of the plan. We believe that no better credit risk exists today than that which has for its security a heavy-duty household appliance in use in an American home and the success of any trial-rental plan is largely predicated upon a faith in this security. Our trial-rental installations have been made with such care that the number of reverts is practically nil, and in every case these have been put back on the lines. At the same time the percentage of appliance saturation has been increased in nearly every case with greater success than has been met with in other properties.

An active program of promotion and dealer co-operation is vital to the trial-rental program. In nearly every case, however, we have found the dealers receptive to the plan as soon as they understood it and they are working with us enthusiastically. Wiring contractors, plumbers and dealers are all tied into the plan. We pay the dealer a commission on the electric range and water heater contract, with a bonus for the conversion of the rentals into sales. We pay the contractor the cost of installation, which varies widely in different localities and on different installations. The usual methods of promotion and sales are cooking schools, radio broadcasting, home service work and personal selling, backed up by newspaper advertising.

It is highly important that the trial-rental plan be handled on a campaign basis rather than set up for continuous promotion. This becomes clearer if the aim of the plan is kept in mind—ultimately to sell the appliance. Then a reasonable time must be given the sales force in order that they may convert the trial rentals into sales before commencing a new campaign. The conversion of trial rentals into sales is proceeding rapidly on our properties and we expect very satisfactory results from this work.

We find that in every town this trial-rental offer appeals to the housewife immediately, as it offers her an opportunity to receive a practical demonstration of the value and economy of the service we are selling under actual working conditions. It is going to prove a powerful influence in building up public interest and confidence in cooking and water heating by electricity.

Some 48 American utilities, both private and municipal, are now engaged in some type of trial or rental activity. Experience in some cities is already extensive. Hartford had about 5,000 out on rental at the end of July this year. Detroit reported more than 1,600. No company has had the plan in operation long enough as yet to give definite guidance as to the number of trial-rental installations that will be taken out at the end of the trial period or the number of rentals that will be converted to purchases. But the indication is that repossessions will be small and sales large.

An Electrified Aqueduct

Los Angeles Aqueduct Built by the Use of a 196-Mile, 66-Kv. Line — Problem of Power Supply Involved Stability Limits — Costs and Results

ELECTRIC power is playing an important part in the construction of the aqueduct which will carry water westward from the Colorado River across 240 miles of practically uninhabited desert to the coastal cities of southern California. Approximately 91 miles of this distance will be traversed in 16-ft. concrete-lined tunnels now under construction. Covered concrete conduit, pressure pipes, open canals and pumping plants covering the balance of the distance are to be built in accordance with a construction program designed to bring the project to completion by January 1, 1939.

The decision to use electricity for the construction work was the result of a thorough survey of the various methods of securing power for the different operations. All existing power sources were considered, as well as the possibility of building new Diesel or steam-generating plants to supply the expected demand.

Assurance of a power supply at the remote locations where the work was to be undertaken removed one of the uncertainties of estimating construction costs and preparing bids.

The estimated curves of energy consumption and maximum demand for the duration of the job were built up from the construction program and formed the basis of the design of the line and studies of the cost of power. The curves of actual use represent tunnel work almost exclusively, since the early part of the program includes practically no work on canals, conduit or plant construction. Power requirements were estimated by considering the connected motor capacity required for each different construction operation and applying to the connected motor capacity, demand factors and load factors obtained from reported experience of similar work.

In the tunnel excavation an average progress of 27 ft. per day for a two-heading camp was assumed; actually, progress has been at the average rate 36 ft. per day. Experience reported from other tunnel jobs indicated an energy consumption of from 20 to 50 kw.-hr. per cubic yard of excavation. The aqueduct estimates amounted to 35 kw.-hr. per cubic yard, but the actual use of energy has been considerably below this figure. However, the more rapid rate of progress has offset the lower energy consumption per cubic yard to give a total monthly consumption very close to the estimated figures. The actual connected loads in the tunnels during excavation are as follows:

Single-heading tunnel	350 to 900 hp.
Double-heading tunnel	650 to 2,150 hp.
Shaft-sinking	400 to 800 hp.

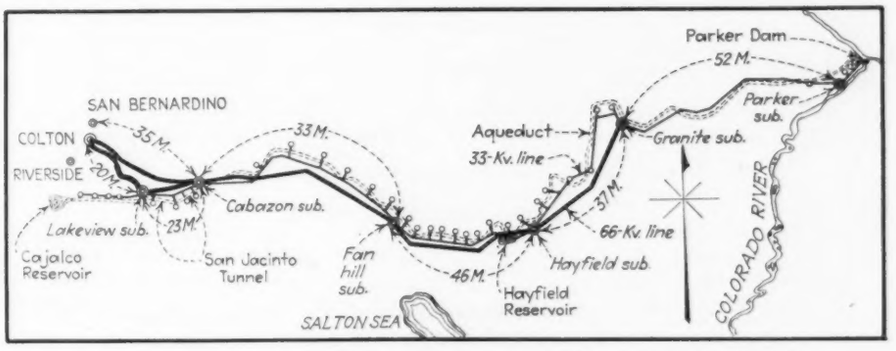
On July 1, 1934, the total connected load was approximately 27,000 hp., with a maximum demand at Colton of 8,200 kw. This represents a demand factor of 40 per cent, which is considerably below the estimated value of 66 per cent. On the other hand, the load factor has been over 75 per cent, as compared with 50 per cent estimated for tunnel work. The actual consumption of energy has been close to the estimates.

It is anticipated that the load factor will be about 35 per cent on conduits and canals, 50 per cent on dam construction and 45 per cent for water supply pumping. The connected loads for various types of construction plant are estimated as follows:

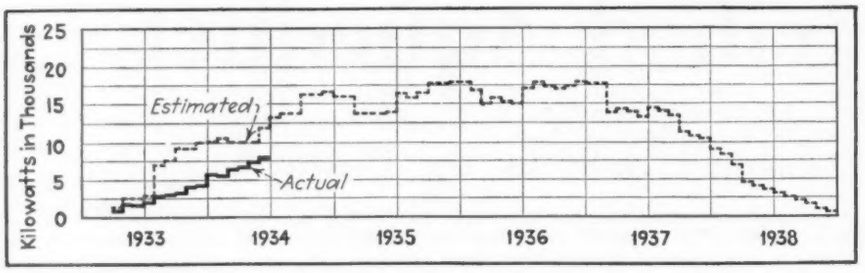
	Hp.
Single-heading tunnels during lining	875 to 1,035
Conduit and siphon construction	450 to 770
Canal construction	585
Gravel screening and construction plants	150
Pumping plant construction	915
Construction of Parker Dam	3,215

The maximum expected connected load is 36,000 hp., with a peak load of from 12,000 to 18,000 kw., depending on the diversity of demand. The

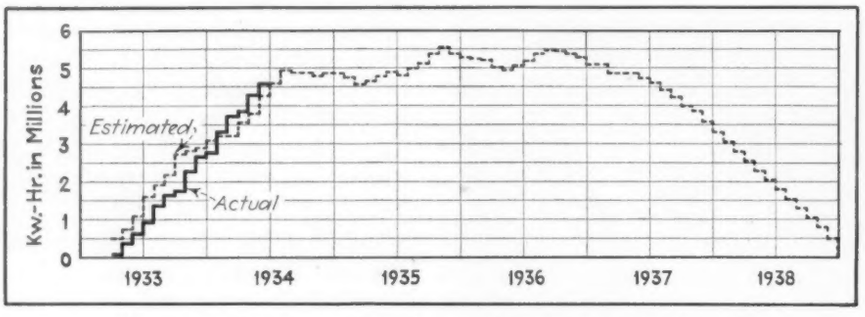
By J. M. GAYLORD
Chief Electrical Engineer Metropolitan Water District of Southern California



An electric power supply was the answer to the construction of the Los Angeles-Colorado Aqueduct



Maximum demand for construction work, actual and estimated



Kilowatt-hours for construction work, actual and estimated

total energy requirement for the entire construction program is estimated as 235,000,000 kw.-hr.

66,000 is economic voltage

Under a contract made in July, 1932, the Southern California Edison Company, Ltd., Los Angeles Gas & Electric Corporation and Southern Sierras Power Company agreed to deliver at Colton a maximum of 23,000 kw. at 66,000 volts. The rate is $1,500 per month for 66 months, plus 95 cents per month per kilowatt of maximum demand, plus 5 mills per kilowatt-hour. The total monthly bills are subject to discounts up to 10 per cent for high power factor.

The transmission system from Colton along the route of the aqueduct was designed and built by the Metropolitan Water District. Uncertainties as to the use of power made it desirable to build a system which would supply a distributed load of 18,000 kw. and which could be readily reinforced to carry a reasonable excess above this expected maximum. The temporary nature of the work made reasonably cheap construction desirable, yet reliability was of great importance, particularly where excavation must be protected by pumping.

A careful study was made to determine the most economic transmission voltage, giving due consideration to the question of steady-state stability. The importance of the latter may be seen from the fact that 4,000 kw. must be transmitted to Parker Dam, which is more than 300 miles from the generating plants on the coast. Furthermore, the fact that the load consists almost entirely of motors makes the power limit somewhat lower than with the ordinary mixed residential and industrial load.

As a result of the stability calculations, transmission at 66,000 volts was found to be not only feasible but economical, especially since it made unnecessary the installation of a

Table I—Accidental Service Interruptions

April 22, 1933, to July 1, 1934

Cause	Number	Total Time Out, Minutes
Lightning, 33-kv. lines	9	365
Lightning, 66-kv. lines	1	2
Mechanical failures, 33-kv. lines	3	556
Mechanical failures, 66-kv. lines	1	134
Mechanical failures, substations	2	133
Errors of operation	7	68
False relay operation	1	7
Power failure at source	2	15
Unexplained	2	19
Total	28	1,299

Table II—Summary of Material Used on Construction Power System

Material	Quantity	Manufacturer
Condensers, 5,000 kva	3	Westinghouse Elec. & Mfg. Co.
Tap-changing voltage regulators, 600 kva	3	Westinghouse Elec. & Mfg. Co.
Transformers, 2,000 kva	21	General Electric Co.
333 kva.	45	Allis-Chalmers Mfg. Co.
333 kva.	25	Pennsylvania Transformer Co.
250 kva.	22	Pennsylvania Transformer Co.
250 kva.	24	General Electric Co.
75 kva. 3-ph.	10	Allis-Chalmers Mfg. Co.
75 kva.	26	Moloney Electric Co.
15 kva.	24	Wagner Electric Corp.
10 kva.	30	Wagner Electric Corp.
Oil switches, 69 kv., 400 amp.	12	Kelman Elec. & Mfg. Co.
34.5 kv., 400 amp.	12	Kelman Elec. & Mfg. Co.
15 kv., 400 amp.	15	Kelman Elec. & Mfg. Co.
7.5 kv., 400 amp.	70	Kelman Elec. & Mfg. Co.
Switchboards	6	Westinghouse Elec. & Mfg. Co.
Disconnecting switches, 66 kv., 400 amp.		Bowie Switch Co.
33 kv., 400 amp.		Railway & Industrial Eng. Co.
2,300 kv., 400 amp.		Pacific Elec. Mfg. Co.
33 kv., pole top		
Batteries		Exide Battery Co.
		Westinghouse Electric Battery Co.

Material	Quantity	Manufacturer
Suspension insulators, 10-in. disk, 5¾-in. spacing	33,004	Westinghouse Elec. & Mfg. Co.
	8,000	Jeffery-DeWitt Insulator Co.
	250	Lapp Insulator Co.
	350	Ohio Brass Co.
	200	Pinco (Joslyn Mfg. & Supply Co.)
Pin-type insulators, 34,000 volt	10,002	Westinghouse Elec. & Mfg. Co.
	1,500	Pinco (Joslyn Mfg. & Sup. Co.)
	500	Jeffery-DeWitt Insulator Co.
	500	Allied Industries
	250	Graybar Electric Co.
Insulator pins	11,617	Graybar Electric Co.
Poles, Douglas fir	430	J. H. Baxter Co.
Western red cedar	1,116	McCormick Lumber Co.
	6,585	Graybar Electric Co.
	1,135	J. H. Baxter Co.
	120	Joslyn Mfg. & Supply Co.
Copper strand, No. 4/0 (lb.)	1,291,724	Anaconda Wire & Cable Co.
	404,203	General Cable Corp.
	440,214	Phelps-Dodge Copper Prod. Corp.
No. 2/0 (lb.)	1,228,944	Phelps-Dodge Copper Prod. Corp.
	360,665	Anaconda Wire & Cable Co.
No. 2 (lb.)	110,000	Anaconda Wire & Cable Co.
	50,145	Phelps-Dodge Copper Prod. Corp.
	32,230	American Electric Works

transformer bank at Colton. It was found essential, however, to maintain a high level of voltage throughout the system, and this is being done by the installation of synchronous condensers and by offering the power users adequate inducement to maintain high power factor. Tap-changing auto-transformers are also installed at several substations as auxiliaries to the regular transformer banks. These make possible the control of voltage conditions on the local feeder systems independently of the operation of the synchronous condensers, which consequently can be operated in a manner best suited to the needs of the system as a whole.

Selection of 66,000 volts for the transmission system permitted a very flexible design, because one line with two or three 5,000-kva. synchronous condensers would be sufficient up to about half or two-thirds the estimated maximum load, and additional lines and condensers could be added or not, according to the load development.

Wood-pole 66-kv. line used

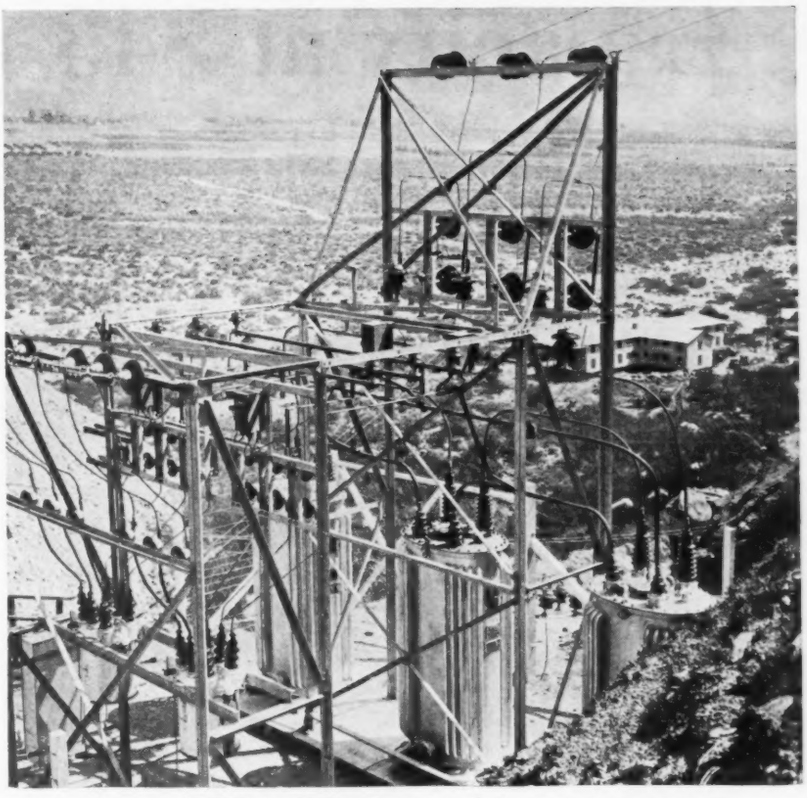
Wood-pole construction was used throughout the transmission system; 196 miles of 66-kv. No. 4/0 copper circuit extend from Colton to Granite substation, about 60 miles from the Colorado River. The line is of H-frame and wooden wishbone construction, the design being varied to meet the different topographic conditions encountered. At intervals along this line are five 6,000-kva. substations at which the voltage is reduced to serve the distribution system. The voltage of 33 kv. was found most economical for the latter because of the great distance between the load points. The 33-kv. distribution line, of No. 2/0 copper, runs substantially parallel to the main transmission system and extends beyond Granite to the Colorado River, constituting at present the only power source for the eastern part of the aqueduct work.

On the distributing system are 34 substations, of 750 to 1,000 kva. capacity, which deliver power at 2,400 volts to the construction work. There are also 27 smaller substations which supply power for wells and booster pumps on the water supply system.

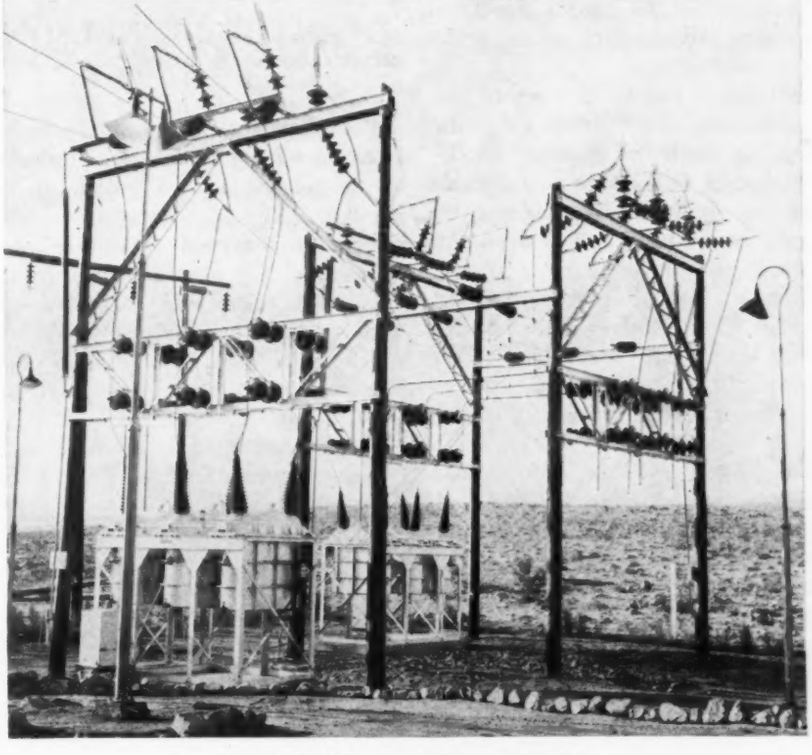
Instantaneous relays clear faults quickly

The 33-kv. line is normally sectionalized between substations so that it operates on the radial feeder principle; however, during outages of any section of the 66-kv. line it is possible, by tieing together the 33-kv. feeders, to make an emergency by-pass capable of transmitting a small amount of power. This arrangement gives service reliability adequate for most of the aqueduct work. For the San Jacinto tunnel job, where a considerable amount of water is being encountered, duplicate service is provided by

[*Continued on page 98*]



Typical 33,000 to 2,300-volt substation to serve contractors



Typical 66-kv. to 33-kv. substation

Capacity at $43 per Kw.

Low Unit Investment More Than Offsets Relatively Low Fuel Efficiency — Municipal Plant Being Kept Modernized

COMPLETE from fuel handling to electrical bus, the city of Taunton, Mass., has recently finished a 7,500-kw. addition to its steam-generating station at a cost of $42.65 per kilowatt. The addition required a new boiler with a rated capacity of 100,000 lb. steam per hour at 450 lb. gage pressure and 750 deg. F. total temperature; a single turbo-generator, condenser, building addition, fuel supply, draft, feed pumping, piping and other auxiliary equipment. On a full condensing cycle the plant will operate on a basis of from 15,000 to 16,000 B.t.u. per kilowatt-hour, and at about 10,000 B.t.u. with maximum steam extraction (about 50 per cent) to a distributing system provided to supply fourteen neighboring industrial plants for heating and processing.

The Taunton system as a whole has cost about $3,000,000, with the only outstanding securities totaling $360,000 in bonds, and as there is a cash surplus of more than $400,000, the property is in effect clear of debt. At full load and with the present system load factor of 45 per cent, the investment cost of the plant addition represents a little more than 1 mill per kilowatt-hour at the generating station bus. The over-all performance of the plant is within 10 per cent of that of the largest modern central stations, most of which operate on an average basis of between 14,000 and 15,000 B.t.u. per kilowatt-hour. This difference in over-all performance means an increase at Taunton of perhaps from 0.5 to 0.75 mill per kilowatt-hour, but as most of the large central stations lately built have involved investment costs of from 4 to 7 mills per kilowatt-hour, even on base-load operation, Taunton's advantage of at least 3 mills far more than offsets the 0.5 to 0.75 mill increase in production cost obtained with full condensing operation. These points mark the Taunton plant as one of the most economical stations built in this country to date.

By ARTHUR L. NELSON
Arthur L. Nelson Engineers, Boston, Mass.

Before considering the plant design features, a few points may be included as to the managerial policy of the municipal lighting commission with respect to system planning and financing. The plant is owned by the city and is managed by a commission appointed by the Mayor and which is in complete control of the property independent of the rest of the city government. In general, the members of the commission have been men engaged as executives operating successful businesses in Taunton. These include prominent manufacturers and merchants and Chester F. Buckley, the general manager of the municipal lighting department, is a graduate of the Massachusetts Institute of Technology and was formerly connected with the Brooklyn Edison Company. F. P. Callahan, president and general manager of C. A. Hack & Sons, printers, is chairman of the board, and other recent members have included President Wastcoat of the Paragon Gear Works, President Ormsbee of the Taunton Pearl Works, Treasurer Collins of the McDonough & Leatherbee Lumber Company and J. F. Mulhern, owner of a prosperous drug business. These names are cited to show the type of board membership which has been responsible for the development of the city system of electrical production and supply.

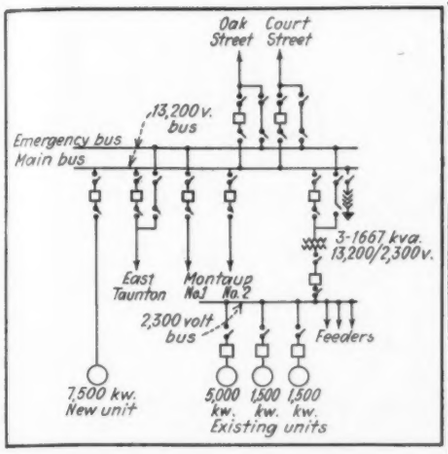
Modernization program of a well-run municipal central station involves low-cost extension and design for over-all operation at about 10,000 B.t.u. per kilowatt-hour when supplying heating and process steam to adjacent industries in addition to community electrical load. Economical financing features the development of the system.

Sound financial policies

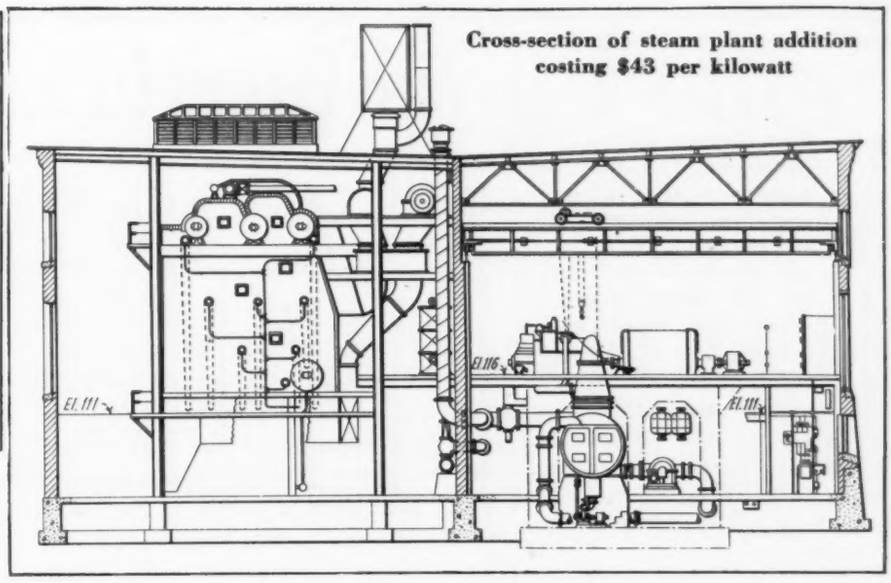
In financing the development of the system the commission has avoided building up a heavy funded debt and has placed the property in excellent physical condition, where it is practically free of any obligations. No bonds have been issued since 1926. Obsolescence has been met aggressively by the almost complete clearing out of older equipment, taking advantage of such salvage as could be realized. The additions financed by bonds issued on the city's credit have borne interest varying from 3½ to 4¾ per cent.

The property is in excellent condition, the service good and the rates for electricity are low. At the West Water Street generating station 80 per cent of the boiler and turbine unit capacity is less than thirteen years old and 40 per cent of the foregoing is less than one year old. The 13-kv. distribution system and four substations are less than ten years old.

This prompt removal of obsolete equipment and the virtually complete retirement of outstanding securities



Single-line wiring diagram of station, showing tie-in between older units. 13-kv. turbo-generator and feeder systems



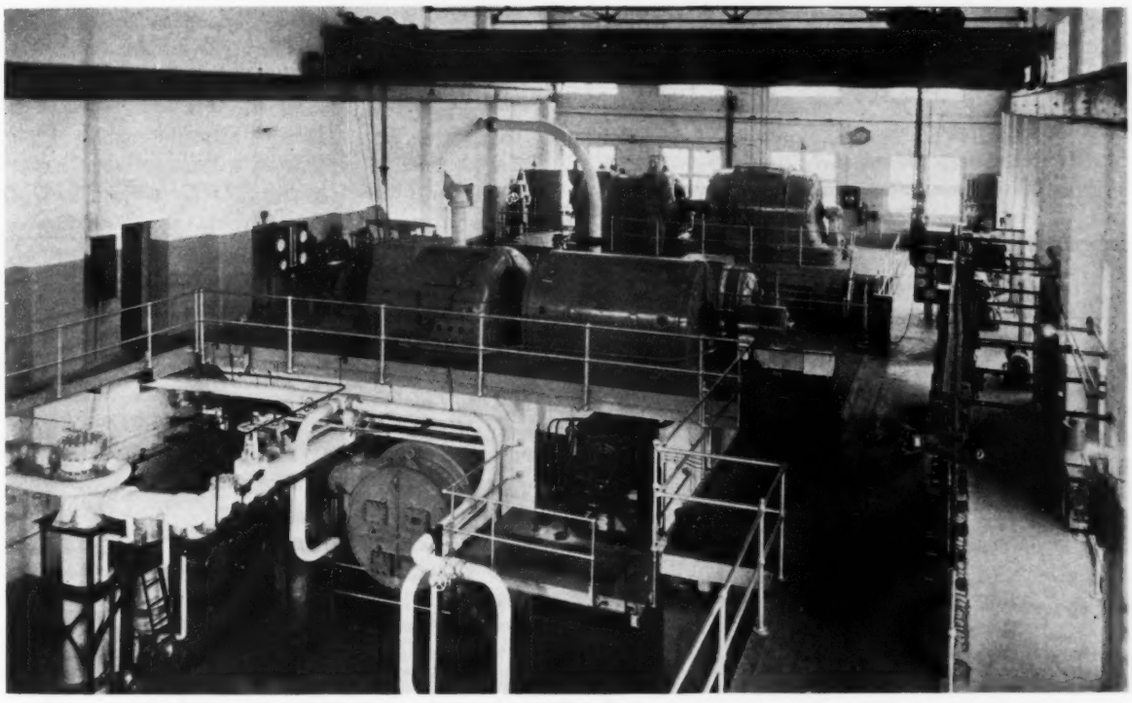
Cross-section of steam plant addition costing $43 per kilowatt

has left Taunton with a first-class property and one which is in a strategic position to take advantage of new developments in the art of producing and distributing electricity. There has been no shutdown of the main generating station for eleven years; the distribution system has a splendid record for reliability of service and voltage control, due to 13-kv. distribution, and its efficiency in operation is indicated by the approximately 14 per cent total loss of energy between the generating plant bus and the customers' meters.

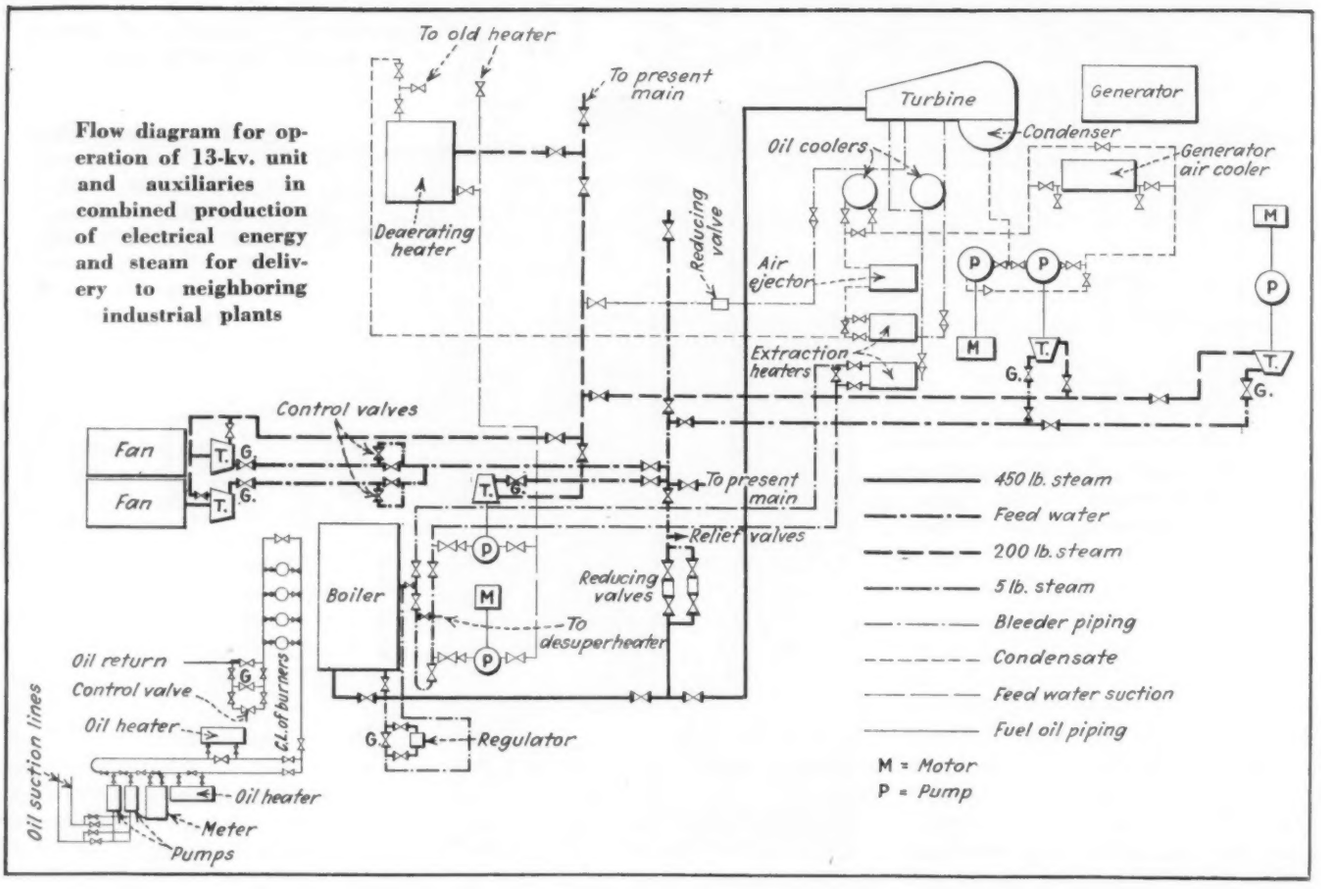
Reductions in rates from time to time have been frequent and have contributed to the upbuilding of the system through increased business encouraged by lower prices. The highest step in the domestic household rate is now 6.5 cents per kilowatt-hour, with lower steps at 4.5 and 2.5 cents. This rate works out to give the residential customer using 200 kw.-hr. a month an average rate of 3.8 cents. Energy is sold to large power users at rates running as low as a little more than 1 cent per kilowatt-hour. The new addition to the West Water Street station, when in full operation, will undoubtedly form the basis of further reductions in the price of electricity for both light and power. At present the plant is tax exempt, but it has made frequent contributions to the city treasury from its surplus, these amounts totaling approximately what would have been paid in taxes, taking into account the property value and the city tax rate. It is probable that in the near future some arrangement will be adopted whereby regular amounts equivalent to ordinary tax payments at the regular rates will be made annually.

System planning handled by engineers

In the development of the physical property the commission has eschewed



View of 7,500-kw. turbo-generator, condenser and field rheostat in Taunton plant addition



Flow diagram for operation of 13-kv. unit and auxiliaries in combined production of electrical energy and steam for delivery to neighboring industrial plants

political considerations and has exhibited a very effective direction of the work of its engineers. For each new plant addition or change contemplated they have required of the writer, who has acted as their consulting engineer for the past fifteen years, carefully prepared estimates of the new investment expected, and predictions of the operating results to be obtained. On this basis they have authorized the various projects. Each project at the start has been very carefully budgeted as regards investment required. A rigid system of cost control has then been established by the consulting engineer, whereby the expenditures have been held definitely within the budgeted costs. So effective has this control been that no project carried out during the last fifteen years has exceeded the budgeted appropriation.

In all additions to property the commission through its engineers has granted an impartial opportunity to all manufacturers of equipment and to all contractors for supplying apparatus, materials and labor for the work, and in every case awards have been made on the basis of the most favorable proposal for the equipment and material suitable. Plant designs have been carried out by an experienced engineering staff, insuring reliable and economical results.

Standard equipment used in extension

The design of the extension is based on the use of standard equipment as listed in Table I and summarized in cost as in Table II. The boiler is equipped with fusion welded drums

[*Continued on page 89*]

Table I–Principal Equipment Taunton Generating Plant Addition

Boiler and Auxiliaries

Boiler, one, Stirling type 10,293-sq.ft. heating surface, 500 lb. working pressure, fusion welded drums.....Babcock & Wilcox
Superheater, one final temperature 725 deg. F., pendant loop type.....Babcock & Wilcox
Soot blowers, 6 elements
Diamond Power Specialty Corp.
Forced-draft fan, one, 28,000 c.f.m. against 8-in. static head driven by Sturtevant turbine and gear.....B. F. Sturtevant
Induced-draft fan, one, 48,000 c.f.m. against 4-in. static head driven by Sturtevant turbine and gear.....B. F. Sturtevant
Air preheater, one, 9,980 sq.ft. Ljungstrom air heater, final temperature 440 deg. F..Air Preheater Corp.
Oil burners, four, mechanical type
Peabody Engineering Corp.
Breeching and ducts.....Jennison Co.
Combustion control.....Hagan Corporation
Reducing valves and desuperheaters, two, one 6-in., one 2-in. with common control. Hagan Corporation

Turbine Generator and Auxiliaries

Turbine generator, one, 7,500-kw., 9,375-kva., 13,800-volt, three-phase, 60-cycle generator with 45-kw., 125-volt shaft exciter driven by 7,500-kw., 3,600-r.p.m. turbine designed for 425 lb. gage throttle pressure, 725 deg. F. total temperature
Westinghouse
Generator air cooler, one, 3,670 sq.ft., two section
Westinghouse
Surface condenser, one, 8,500-sq.ft., two-pass with dual-driven 7,000-g.p.m. circulating water pump, one motor-driven 160-g.p.m. condensate pump, one steam-driven 160-g.p.m. condensate pump and two-stage twin air ejector unit mounted on common inter and after coolers.....Westinghouse

Feed Water Equipment

Extraction heaters, two; one low-pressure, 160 sq.ft., one high-pressure, 320 sq.ft., vertical type
Westinghouse
Deaerating heater, one, 100,000 lb. per hour capacity, cast-iron shell.....Elliott Co.
Feedwater pumps, two, 225-g.p.m. 1,500-ft. head, four-stage, 3,550-r.p.m., one turbine driven, one motor driven.....Warren Steam Pump Co.
Control valves, three, pump control and boiler water regulator.....Swartwout Co.

Piping Valves and Fittings

Valves.....Lunkenheimer Co.
Chapman Valve Manufacturing Co.
Fittings.....Pittsburgh Piping & Equipment Co.
Non-return valve
Edward Valve & Manufacturing Co.
Fabricated piping.....Lumsden & Van Stone Co.

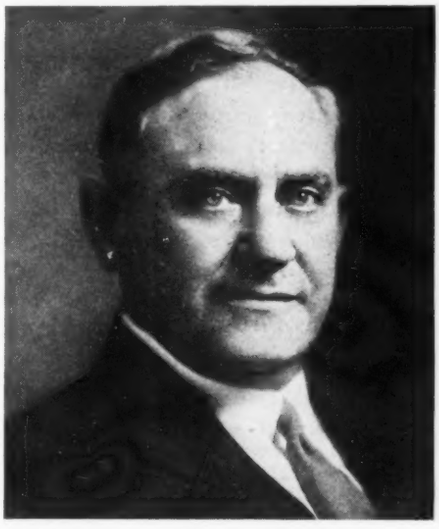
Instruments

Recording thermometers.....Foxboro Co., Inc.
Indicating thermometers....Moeller Instrument Co.
Steam flow meters.....Bailey Meter Co.
CO_2 recorder.....Republic Flow Meters Co.
Draft gages.....Paul B. Huyette Co., Inc.
Pressure gages.....Crosby Steam Gage & Valve Co.

Utility Merchandising Policy

A Review of the Practice of 45 Prominent Utilities and Some Comment Thereon—Inconsistencies Shown

Power company sales managers and their bosses are local-minded men. Most of their methods and policies have grown out of the experience of their own companies in their own towns. Therefore there is an endless and confusing divergence in merchandising practice, incompatible with the fact that they are all in the same business of selling electric service to American families. Mr. Michel here points out some of the inconsistencies presented by a review of the methods of 45 companies and asks the pertinent questions. Which ones are right? Why don't we find out?



By C. E. MICHEL
Sales Manager
Union Electric Light & Power Company
St. Louis, Mo.

NOT long ago I had occasion to check up the merchandising policies of some 45 of the outstanding power companies of this country and compare their methods. Every one stressed the need for building up the domestic appliance load and the value of developing co-operation for the local retailers and contractors. But the policies followed in the effort to achieve these ends are so at variance as at times to be in actual conflict. Some believe in active merchandising. Some do not. Those that do differ widely in practice.

For example, in some cases companies have discontinued their sales floors. Others maintain a passive sales floor activity with no advertising. Some have turned their sales floors over to dealers in whole or in part. Others take orders for merchandise in the name of the dealer only. Some take leads only, which are then turned over to the dealer or distributor for actual consummation of the sale. Still others maintain an aggressive selling policy on these floors.

In the operation of appliance sales crews a similar situation is encountered. One group uses to the fullest extent this effective method of selling electrical specialties. Others have abandoned crew work entirely. Still others sell aggressively and turn over the sales so made to some neighborhood dealer.

There are cases where utilities aggressively sell small appliances only. There are others in which these appliances are sold not at all and selling effort is devoted exclusively to major appliances. A number of companies confine their aggressive sales activities to major appliances that have not as yet attained customer acceptance. We find, however, a wide difference of opinion as to just what constitutes customer acceptance. Policies on the sale of ranges, refrigerators, water heaters, radios and some small appliances illustrate this.

A few companies are now engaged in range and water heater rental. Some restrict these to selected types of homes or individuals. Others use no such restrictions. Still others have entered agreements with dealers not to offer rental or trial on any appliance. On the wiring for electric ranges, policies vary from no help whatsoever to absorption of the entire wiring cost, and in one case a utility reports its out-of-pocket cost on the sale and installation of ranges as $150 each. Deferred payment policies vary from deferred payments on merchandise regardless of the size of bill to none at all, but we have not discovered a case where deferred payments are allowed without an equitable charge being made therefor.

Advertising programs are equally varied, but a trend toward co-operative advertising is quite marked. In some cases such advertising, paid for by the utility, is done in the name of an electric league. In other cases it appears over the name of the utility with reference to the fact that non-utility outlets are offering similar merchandise. At times dealers are listed by name and in some cases the expense is borne jointly by the utility and dealers. Some utilities run merchandising advertising for the benefit of their own stores exclusively. Others have entirely ceased to run such advertising.

In methods of co-operating with dealers there is also wide divergence. Some confine this to a bare recognition of the principles of ethical merchandising. Others have apparently built their entire sales organization to accomplish this purpose and have undertaken the whole burden of planning, advertising, selling and demonstrating, handing over to the dealers the fruits of their work. Between these extremes may be found policies of every complexion.

Examples of sales policies

To get the sense of confusion in policy and method it is only necessary to glance over the following brief abstracts of the reports received from the 45 companies I have referred to. This is the nub of their own statements of their present practice. It is not complete, but it indicates the utter lack of a common understanding of

the common problem or any uniformity in our approach to it:

1. *Southern*—Sells appliances as a help to lower rates.

2. *Northeastern*—Merchandises small appliances only in small communities. In large towns concentrates on ranges and water heaters.

3. *Northeastern*—Sells all appliances actively. Extends easy payments.

4. *Southeastern*—Quit merchandising two years ago, except ranges and water heaters. Maintains a planned co-operation with dealers.

5. *Southeastern*—Merchandises all appliances actively. Co-operates with dealers.

6. *East Central*—Sells all appliances but may discontinue and support a local league program.

7. *Northern*—Sells all appliances. Coordinates dealer activities through electrical association.

8. *Southern*—Sells all appliances, with limited rental of range and water heaters.

9. *Northeastern*—Stopped selling refrigerators and small appliances last year. Rents ranges.

10. *South and Midwest*—Intensive merchandising effort. Dealer tied into all activities. Bonuses to dealers' salesmen on range and water heater sales. Company pays for wiring. Renting ranges and financing certain dealer sales in the south.

11. *Eastern*—Quit merchandising in 1933. Provide display and demonstration to support dealers. Train dealers' salesmen.

12. *Northeastern*—Stopped selling appliances last year. Displays for manufacturers and wholesalers. Finances dealers' time-payment sales. Secures leads for dealers. Provides promotional advertising.

13. *Northeastern*—Sells small appliances passively. Promotes ranges, water heaters actively. May drop refrigerators, leaving all popular appliances to co-operative promotion.

14. *Eastern*—Quit merchandising in 1933. Outside staff closes sales for dealers. Utility pays salary. Dealers pay commission.

15. *Northern*—Sells all appliances actively. Dealers participate in campaigns and utility finances the time sales.

16. *Northern*—Merchandises full line aggressively. Dealers not featured.

17. *Midwestern*—Same as 16.

18. *East Central*—One store. Outside salesmen discontinued. Co-operates with dealers in special campaigns.

19. *Southern*—Merchandises all appliances except ranges and water heaters, desk and floor lamps. Plans to discontinue all appliances with customer acceptance and develop dealer sales. Finances dealers on refrigerators.

20. *Northern*—Sells all appliances that offer worth-while revenue. Representatives assist dealers in making sales and receive commission. Utility pays "excess cost" on range installations.

21. *Northern*—Sells all appliances, but pushes only major items not in conflict with dealer operations. Reduces activities as merchandise achieves public acceptance. Dealers participate in all campaigns.

22. *National*—Chain of utilities selling all appliances, with emphasis on major devices. Cleaners, washers and small appliances sold principally in stores. Active co-operation with dealers.

23. *East Central*—No merchandising for twenty years. Co-operates through electrical league. Now considering rental of ranges and water heaters.

24. *North Central*—Sells all appliances to stimulate dealers. Not aggressive. Modest co-operative advertising, few campaigns. Main effort now on ranges.

25. *Midwestern*—Sells only a few small appliances that need pioneering. Actively promotes major appliances.

26. *North Central*—Sells full line aggressively. Does not believe dealers can build load.

27. *North Central*—Merchandises full line. Sells ranges and water heaters co-operatively. Provides advertising, demonstrating, servicing. Finances time-payment accounts.

28. *Southern* — Merchandises all appliances. Dealer co-operation not mentioned.

29. *North Central*—Sells full line, but has cut down activities by two-thirds within the year.

30. *East Central*—Quit merchandising in 1932. Dealers now want utility to finance and operate all promotional activities.

31. *Midwestern* — Merchandises aggressively.

32. *Southwestern*—Sells small appliances, ranges and water heaters. Works through dealers on other lines. Dealers report sales monthly. Co-operative advertising.

33. *Midwestern* — Merchandises aggressively with outside salesmen. Increasing attention to dealer co-operation.

34. *Midwestern*—Quit selling small appliances in 1932. Actively pushing only refrigerators and ranges. No organized dealer co-operation.

35. *Southwestern*—Sells small appliances in store only. Gives easy payments. Promotes and sells ranges. Refrigerators sell only through dealers, with utility promotion.

36. *Southwestern*—Sells all appliances aggressively. Supports dealers with co-operative advertising.

37. *Midwestern*—Sells full line. Ties dealers into advertising.

38. *Midwestern* — Merchandising prohibited by law. Co-operates with dealers.

39. *Western*—Sells all appliances through stores and outside salesmen. Promotes revenue-building lines and urges dealers to participate.

40. *Western*—Sells all appliances. Campaigns only on refrigerators, ranges and water heaters.

41. *Far Western*—Sells heavy-duty appliances only, no refrigerators or small devices. Has no stores. Supports dealer groups with co-operative advertising.

42. *Far Western*—Merchandises small appliances in store and major items by outside salesmen. Withdrew from sale of larger appliances in two territories. Not aggressive on refrigerators. May rent ranges.

43. *Far Western*—Sells major appliances actively. Campaigns small devices periodically with dealers.

44. *Far Western*—Withdrawing from direct sales on small appliances and promoting dealer sales. Co-operative program. Utility sells equipment in promotional stage.

45. *Southern*—Sells major appliances actively. Small appliances are displayed, but sold through dealers. Co-operative promotion.

COMMON POLICY NEEDED

Of 45 power companies 38 are merchandising appliances. Of the 38 only 21 sell a full line aggressively. Only 28 mention co-operation with dealers.

This absence of common policy and the diversity in merchandising practices jeopardize the ability of the industry to get the domestic load. Changed policies and new organizations are needed. Many individual efforts are now being made to do this, but there is no central clearing house to get the utmost uniformity, the most effective organization and the impetus that comes from a common promotional and sales effort.

No common practice or policy

In a word, of the 45 power companies 38 are merchandising appliances, seven are not. Of these 38 who do sell appliances, 21 are selling the full line aggressively, seventeen are passive or sell in part, seven do not push small appliances, some do not commit themselves as to ranges, three say that they may discontinue selling all or in part, 28 mention co-operation with dealers. All the way through, there is the impression of diversity that suggests no clear-cut issue or principle, but rather uncertainty and experiment.

The purpose of this article, however, is to submit the fact that now, as never before, the utility needs the domestic appliance load. Without such load, future reductions in domestic rates are jeopardized. For once an electric system is in efficient operation, the total day-by-day cost of operating that system is subject to but small and gradual change. But with the increased sale of service to customers already on the line, the cost of the service goes down and, likewise, the price at which it can be sold. Also residential customers, taken nationally, are today using but a fraction of the number of appliances they can profitably use. Since this is so, why do we continue to theorize and experiment? We are all in the same business. We are selling domestic equipment and electric service to American families. Neither the location nor the character of the city makes much difference in the principles underlying merchandising policy and practice.

All cannot be following the most effective and efficient procedure, when the procedure varies so greatly. It is hard to understand and reconcile the wide divergence shown; therefore, it would seem worth while to make a serious study of this whole situation and lay down some guiding rules. Which ways are right? Why don't we find out?

Makes P.F. Correction Pay

How a Large Industrial Plant Tackled Poor Power Factor as an Element of Diverse Production Economy and Results Obtained

By J. W. NASH

Plant Engineer Bendix Aviation Corporation, South Bend, Ind.

No one kind of pill is a general specific for the pathologic condition of low power factor in an industrial plant. A complete cure requires a balanced treatment based on a competent diagnosis of symptoms. Here is a case history that proves the necessity for a co-ordinated approach—and offers one which may be applied to advantage in many instances.

OUT of ten ways considered as means toward the improvement of power factor in the plant of the Bendix Aviation Corporation at South Bend, Ind., the one requiring the largest money outlay was chosen. This was not because Bendix executives are any fonder of spending money than other people, but in simple recognition of the fact that in power-factor correction, as in everything else, if you want a good job you have to pay for a good job.

Diverse combinations of static and rotary condenser capacities, of synchronous motor drives and of remotorization of machines could have been set up. But the objective study and estimates made three years ago were to find an adequate and economical course toward such improvement of the then average plant power factor of about 65 per cent as would result in lower power bills and better operating conditions all around.

Power is purchased from the Indiana and Michigan Electric Company at 27,000 volts on a coal cost correction and kva. per year basis, in which is included an allowed energy usage per unit of demand and plus a kilowatt-hour charge for consumption in excess of the demand allowance. This is an annual charge per kva. of demand and for this charge a certain amount of energy may be used. This amounts to a first step energy rate. In addition, energy use above this certain amount is paid for at a stated unit rate. And, quoting from the contract:

When the average monthly and/or yearly power factor is above or below 85 per cent the total monthly and/or yearly charge exclusive of correction for coal cost will be increased or decreased in accordance with the following table:

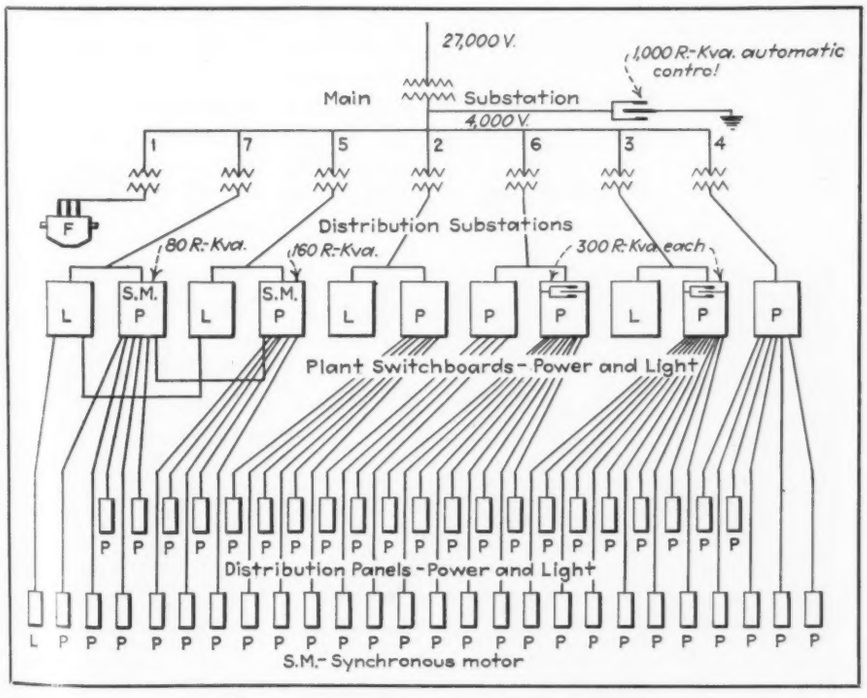
Per Cent P. F.	Per Cent	Per Cent P. F.	Per Cent
100	decreased 4.9	70	increased 8.3
95	decreased 3.5	65	increased 12.5
90	decreased 1.9	60	increased 17.9
85	decreased 0.0	55	increased 24.6
80	increased 2.3	50	increased 33.3
75	increased 5.0		

For the purpose of monthly billing the contract expresses itself in terms of one energy charge per unit for consumption up to the monthly allowance per kva. of demand plus a lower energy charge for usage in excess of the allowance. The total of monthly payments may be more or less than the yearly bill calculated on the contract terms. If so, a correction from or to the utility is made.

Two ways to power cost reduction

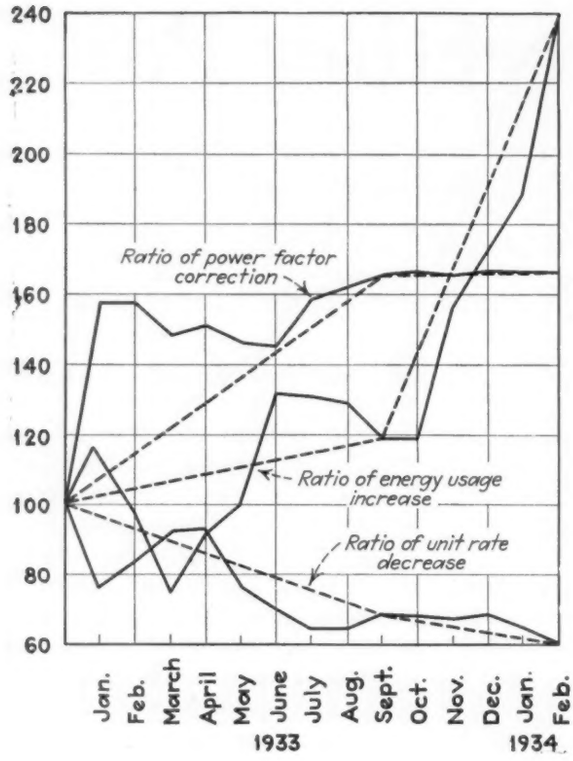
Hence improvement of power factor from a value of 65 per cent to unity would be to decrease the cost of power by a percentage equal to the 17.4 stated in the table of bonuses and penalties plus a proportion determined by the reduction in amount of energy paid for at the higher of the two kilowatt-hour rates.

It is pointless to recount here all of the details of the ten estimates of



Where corrective equipment was applied

This schematic diagram of the Bendix electrical installation shows a total of 1,840 r.-kva. in corrective capacity. Of this the two 300-r.-kva. capacitors are permanently connected, 240 r.-kva. is available when air compressor synchronous motors are in use and the 1,000-r.-kva. capacitor in the main substation is in operation when the total demand is 900 kva. or above.



Inter-relation of power factor, energy consumption and unit rate

These curves for 1933 and the first two months of 1934 show monthly power factors, energy usages and unit rates in percentage ratios of their corresponding values in 1932. The curves begin with December, 1932, at 100 per cent because this is the last month of uncontrolled operation before power factor correction and load control became effective. Comparison of various time-coincident sections of these curves indicate that, within the range of its possibilities, power-factor improvement is a more important determinant of the unit rate than is increase of energy usage. Evidence of this is apparent from the inclinations of the curves before and after September, 1933, shown by the dotted lines. These lines show that the major decrease of unit rate was coincident with the major improvement of power factor and the minor increase of energy usage. Conversely, the minor decrease of unit rate accompanied the minor improvement of power factor and the major increase of energy usage. The accompaniment of major increase of energy usage with minor decrease of unit rate was not caused by a rise in the demand factor in power purchase as is shown by the continuous improvement of load factor in the tabulated record of energy use.

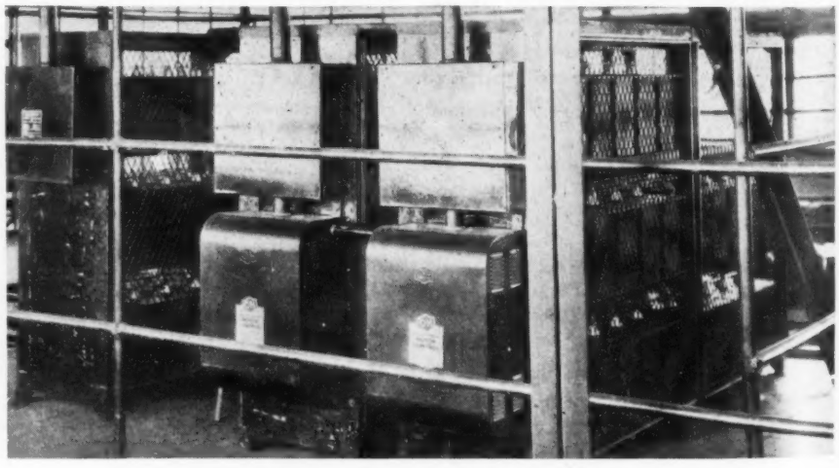
methods and costs for correction as set forth in the 1931 study. Plan No. 10 included 600 r.-kva. in static condensers installed on the distribution circuits and 1,000 r.-kva. in a static condenser installed at the plant service entrance substation. Of this total capacity the 600 r.-kva. on the circuits would be of manual control, as would be also a possible 300 r.-kva. available from the synchronous motors on air compressors if it were decided to make this change. The 1,000 r.-kva. in the substation was contemplated to be in automatic control arranged to cut in and out as the total plant demand approached and receded from an established point.

Remotorization of machines did not appear as a cost in any of the ten propositions, although it figured very largely in the power factor study. It was kept out of the comparison because it would affect all of the estimates equally and therefore would not change their relative positions in regard to cost. However, the importance of remotorization as a power-factor correction means is indicated by an analysis of the effect of replacing standard general-purpose motors with high-torque, high-slip motors on punch presses. The analysis covered 36 presses used in the production of Bendix brakes and showed that the motors driving them could be reduced from a total of 431 to 206 hp. But the proper matching of motors and loads, while it is an effective, and is theoretically the best, means of power-factor correction, is rather a difficult proposition to be carried out in one swoop unless advantageous disposal of the replaced motors can be made immediately. To buy new motors and sell the old ones second hand is usually a less profitable course than installing corrective equipment. For this reason, and also because it was to be expected that plant expansions would offer opportunities for bettering motor size applications, it was decided not to consider remotorization in the cost consideration of power-factor improvement. But it has by no means been dismissed as a practical policy and is being continuously carried out as places of use for displaced motors arrive in plant changes and enlargements.

How the job was done

Proposition No. 10 cost finally about $21,000. The two air compressors originally thought of for change to synchronous motor drive are still getting along with induction motors of 150 hp. each. This is because the plant air requirements increased more rapidly than was expected in 1931, and two more compressors had to be installed; both were equipped with synchronous motors, one of 150 hp. and the other of 300 with an available corrective capacity of 240 r.-kva.

The original 600 r.-kva. to be placed on the 440-volt distribution circuits was left unchanged. No attempt was made to secure the ultimate of corrective effect from these installations by putting them in small units at the motors. They were placed in two 300-r.-kva. capacitors at the plant switchboards so that their effects would be felt on the transformers in the distribution substations. The 1,000-r.-kva. static condenser in the main substation is on automatic control, as was originally planned. The control is such that the condenser goes on the line when a demand of 900 kva. or



Reactive capacity at utilization voltage

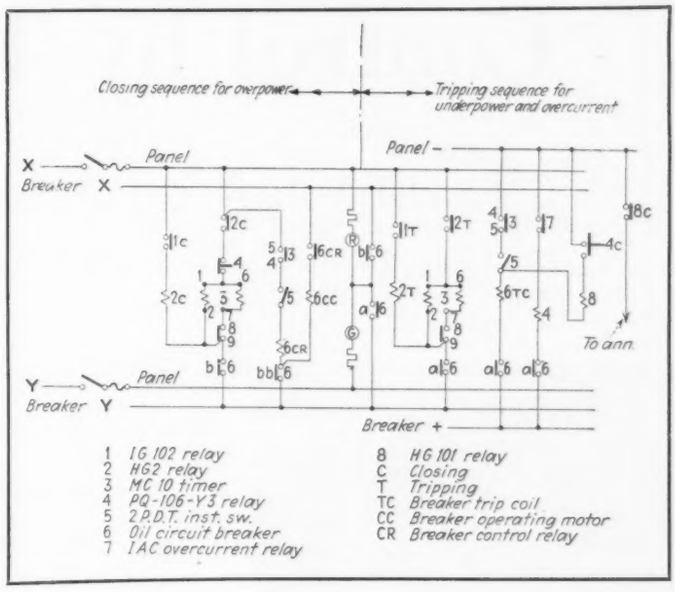
In addition to the 1,000 r.-kva. which is used as required to correct total plant power factor, two condenser banks of 300 r.-kva. each, of which this is one, operate continuously on the 440-volt system.

more is held for two minutes. It remains on for nine minutes after the demand has dropped below 900. The reason for the automatic control is because at night and other times of low total plant load the condenser itself might operate to lower the average power factor, since the power contract makes no discrimination between lag and lead.

From the accompanying record of Bendix kw.-hrs., kva.-hrs., power and load factors and demands in kw. and kva. from April, 1932, through January, 1934, and the graph of relationships between power factor, energy usage and unit rate the effect of power-factor correction is readily apparent. The record shows also that correction did not follow immediately upon the study of 1931 and the power factor grew steadily worse through 1932 until the correction program was started. The first upward step appears in December, 1932, when the installation of 600 r.-kva. was made on feeders Nos. 3 and 6. The tabulation is expanded for the last three months to show feeder condition details, which indicate an overcapacity of r.-kva. on feeder No. 6 and feeders No. 2 and No. 4 not yet corrected. Feeder No. 5 does not appear in the tabulation because it is held as a spare with its load carried on No. 7 through 440-volt ties between the plant switchboards. It is intended eventually that there shall be ties of this kind linking all feeders together, and when this is done the surplus of reactive capacity on feeder No. 6 will thus be distributed among the others that need it. Also, the consistent attention to proper matching of motors and loads in new machine installations plus such changes of motor sizes as circumstances give opportunity for will gradually erase the power-factor differences between the feeders. In the meantime the automatically controlled reactive capacity in the main substation prevents these low feeder power factors from affecting the power cost.

The floating condenser

This 1,000 kva. of reactive capacity is connected phase to ground on the 4,000-volt side of the main transformers. It is automatically controlled to cut in and out when the total plant load reaches and recedes from a fixed value.



The results that followed

It would be very convincing evidence of the value of power-factor correction if this article could be concluded with figures showing the reduction in power cost accomplished by it. However, this is not possible because, coincident with the installation of the corrective equipment, a definite improvement in load factor occurred. And some of the reduction in power cost, a considerable part of it, in fact, must be credited to the higher load factor.

The improvement in load factor was due to some extent to a bettering of load conditions caused by rising production of the plant, but most of it was the result of co-ordinating the heavy load of the iron melting furnace, which is shown as the only load of feeder No. 1 in the schematic diagram, so that it does not coincide with the times of high demand occurrence of the rest of the plant load.

The readers of this article will have to be content with the accompanying graph which shows a continuously descending curve of power cost since the power-factor correction was made. And the evidence of that descending curve is corroborated by calculations showing that the power bill would have been $28,000 higher in 1933 if power-factor improvement costing $21,000 and load-factor improvement costing nothing had not been made.

Record of Energy Use—Bendix Aviation Corporation

Meter Reading Date	Item	Metered Kw.-Hr. 1,000	Metered R.-Kva.-Hr. 1,000	Per Cent Power Factor	Peak Demands Kva.	Peak Demands Kw.	Per Cent Load Factor
4/20/32	Plant total	427.5	622.5	56.5 lag	2,775	1,950	29.9
5/20		420	637.5	55 lag	4,350	3,300	17.4
6/20		412.5	562.5	59 lag			
7/20		412.5	615	55.5 lag			
8/19		240	465	46 lag			
9/19		240	457.5	46.5 lag			
10/20		375	532.5	57.5 lag			
11/19		502.5	592.5	65 lag			
12/20		577.5	555	72 lag			
1/19/33		555	180	95 lag		1,950	38.9
2/18		465	157.5	95 lag	2,400	2,175	29.2
3/20		360	180	89.3 lag	1,875	1,725	28.5
4/20		442.5	202.5	90.9 lag	2,175	1,800	33.6
5/20		555	292.5	88 lag	2,625	2,325	32.6
6/20		629.9	351.1	87.5 lag			
7/20		624	200	95.5 lag	3,280	3,040	28.1
8/21		616	144	97.5 lag	2,320	2,080	40.4
9/19		568	48	99.5 lag	2,400	2,240	34.7
10/19		568	8	99.9 lag	2,400	2,160	35.9
11/18	Feeder No. 1	100.8	50.4	89.5			
	Feeder No. 2	40	46.4	65.5			
	Feeder No. 3	108.8	14.4	99			
	Feeder No. 4	156.8	224	57.5			
	Feeder No. 6	64	112	49.5 lead			
	Feeder No. 7	236.8	118.4	89.5 lag			
	Plant Total	744*	32	99.5 lead	3,040	2,800	36.4
12/19	Feeder No. 1	120	55.2	91 lag			
	Feeder No. 2	43.2	48	67 lag			
	Feeder No. 3	116.8	16	99 lead			
	Feeder No. 4	160	22.4	58.5 lag			
	Feeder No. 6	59.2	123.2	43.5 lead			
	Figure No. 7	297.6	134.4	91 lag			
	Plant Total	824*	0	1	2,880	2,560	44.1
1/19/34	Feeder No. 1	98.4	45.6	91 lag			
	Feeder No. 2	48	51.2	68.5 lag			
	Feeder No. 3	16	16	1			
	Feeder No. 4	195.2	249.6	61.5 lag			
	Feeder No. 6	72	105.6	56.5 lead			
	Figure No. 7	313.6	144	91 lag			
	Plant total	904*	0	1	2,720	2,480	49.8

* Plant total metered on 27,000 volts incoming and feeders on 4,000 volts secondary. Therefore plant total is more than sum of feeder quantities.

Control by Tap Changer

Combined Voltage and Phase-Angle Regulation Applied to Tie-Line and Network Feeders in a Metropolitan Area

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New York Edison Company

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Transformer Division,
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CONTROLLING the output voltage of a transformer by changing its taps under load is now common practice and occasionally regulating transformers which are provided with tap-changing-under-load equipment have been used in controlling the exchange of wattless power over interconnecting ties between generating stations or systems. A very few installations have also been made of regulating transformers which employ tap changing under load as a means of introducing a varying phase displacement at a suitable point in a high-tension network in order to control the division of actual power between the circuits of the network, but it is unusual to find an application where the simultaneous control of load division and of wattless power interchange is accomplished by a single regulating transformer with only one tap-changing-under-load equipment and its accessories. Such an application has been made on the power system in New York City.

Broadly stated, the problem in this application involved a transfer of power in either direction over two direct ties between the Hell Gate and Hudson Avenue generating stations without requiring any phase displacement between the buses of the two stations. This scheme looked toward the transfer over these direct ties under normal conditions of all power interchange between the two stations, rather than permitting part of the power flow to divide itself more or less indiscriminately among several other circuits which formed a connection between the two stations in parallel with the direct ties, but which were intended primarily for use in supplying load to the distribution system rather than for load transfer.

It was also desired to have the station which was sending out actual power over the two direct ties supply a commensurate amount of lagging wattless power in order that the receiving station might not be relieved of energy load without being correspondingly relieved of reactive load. Several possible schemes for accomplishing the desired result were studied, and it is believed that the plan finally chosen and described in this article represented a very simple and satisfactory solution.

Manipulation of tie-line power flow without phase displacement between station buses appears to contradict fundamental principles. But in the presence of other paralleling network feeds the control is possible. One tap-changing mechanism serves in this new development to direct both power and reactive movements without interfering with economic load allocation to stations.

The results of the studies made and the final decision as to the best plan of meeting the requirements can probably be more easily understood by approaching it in the steps shown in Fig. 1. That the series winding *c* is excited from phase *C* and connected in phase *A* of the line which gives a 60/120-deg. phase relation with phase *A* is seen from Fig. 1d. By putting taps in the winding *c* and moving along this winding by means of tap-changing-under-load equipment voltage and phase angle are controlled.

A further step in economy was made possible by using a series winding covering only half the range; that is, half as long as the series winding *c*, shown in the sketch. By reversing the voltage of this winding the entire range can be covered. The "buck" and "boost" positions are obtained by reversing either the series or the shunt winding by a mechanical reversing switch. The latter method was finally decided upon and Fig. 2 shows the schematic connection.

The shunt winding of the regulat-

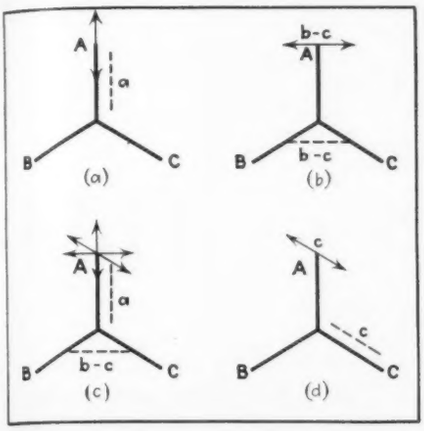

Fig. 1—Voltage and phase angle regulated by one operation

(a) Only voltage regulation is obtained if the series winding *a* (connected in series with the line) is excited from phase *A* of the shunt or exciting winding.

(b) Only phase angle is regulated when the series winding *b-c* is connected in the line at *A* and excited by phases *B* and *C* through proper connection of the tap-changing-under-load equipment across those two phases.

(c) Both effects can be obtained by combining the two functions. By choosing proper increments of in-phase and quadrature voltage a boost in voltage with advance in phase angle and a buck in voltage with retarded phase angle can be obtained. Two mechanisms for tap-changing are, however, required.

(d) More simply and with one set of tap changers the combined effects can be produced by exciting the series winding *c* (in phase *A*) from phase *C*. The details of this scheme are shown in Fig. 2.

ing transformer is excited from the 27,200-volt circuit and the series winding is connected in series with this same circuit. The preventive auto-transformer is switched by the tap changer along the taps located in the series winding which provide the variation in voltage and phase angle.

The regulating transformer and the preventive auto-transformer are mounted in the same tank and the tap changer and reversing switch are mounted integrally with the tank. Fig. 3 shows the regulating transformer with the housing for both the tap-changing-under-load mechanism and the reversing switch.

No effort will be made to cover the details of construction of the tap-changing equipment or the reversing switch, but a brief statement of the principle of operation is attached to the illustration (Fig. 2).

With this 60/120-deg. scheme of regulation it was possible to meet the requirement of delivering 40,000 kva. to the Hudson Avenue bus when the series winding was inserted in the line at the 60-deg. angle and deliver 40,000 kva. in the other direction to Hell Gate with the series winding inserted in the line at the 120-deg. angle

Taps from the series winding connect to the tap selector switches, designated as 1 to 9 inclusive. These switches are connected to the load transfer switches *R*, *T* and *S*. The load transfer switches, as the name implies, perform all of the load-switching operation, opening before and closing after the tap selector switches, thereby restricting all arcing to the switches *R*, *T* and *S*. The voltage of tap 1 is obtained at the mid-point of the preventive auto-transformer with selector switch 1 and load transfer switches *R* and *S* closed. To change taps one step the switches are operated in the following sequence:

1. Selector switch 2 is closed.
2. Transfer switch *S* is opened.
3. Transfer switch *T* is closed.
4. Transfer switch *R* is opened.
5. Transfer switch *S* is closed.
6. Selector switch 1 is opened.

The reversing switch uses only two transfer switches, *X* and *Y*, and two selector switches, 10 and 11. The sequence of operation of the reversing switch will be such that switches *X* and *Y* will close after and open before switches 10 and 11 respectively. With the tap-changing-under-load equipment on position 9 no line current passes through the series winding and it is only necessary for the transfer switches *X* and *Y* to open the exciting voltage of the shunt winding. Assuming that transfer switch *X* and selector switch 10 are closed, then switch *X* opens and switch 10 opens. Following this, switch 11 closes and then switch *Y* closes. This reverses the voltage of the shunt winding and, hence, that of the series winding.

The control circuits of the tap-changing-and-reversing switch are so interlocked that the reversing switch cannot be operated unless the tap changer is on the neutral position 9, and *vice versa*, the tap changer cannot be operated unless the reversing switches are closed.

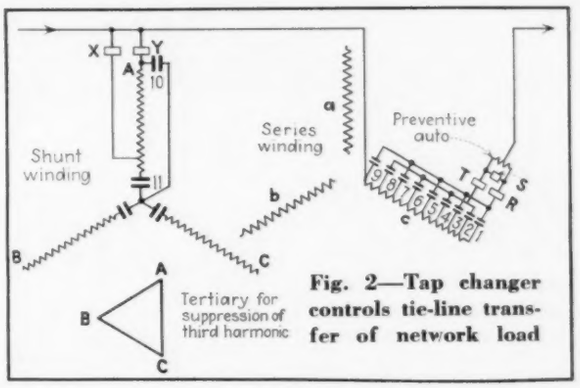

Fig. 2—Tap changer controls tie-line transfer of network load

without requiring any phase displacement between the Hell Gate and Hudson Avenue buses in either case.

The New York practice in load dispatching is such that loads are assigned to the various generating stations from time to time during the day as the requirements of economy may dictate without making any attempt to hold a steady load on the interstation ties. The load on the ties between Hell Gate and Hudson Avenue is, therefore, highly variable in character and consequently a continual changing of taps is required in order to keep the phase displacement between the two stations at a minimum value so that an unusually severe duty is imposed on the tap-changing equipments.

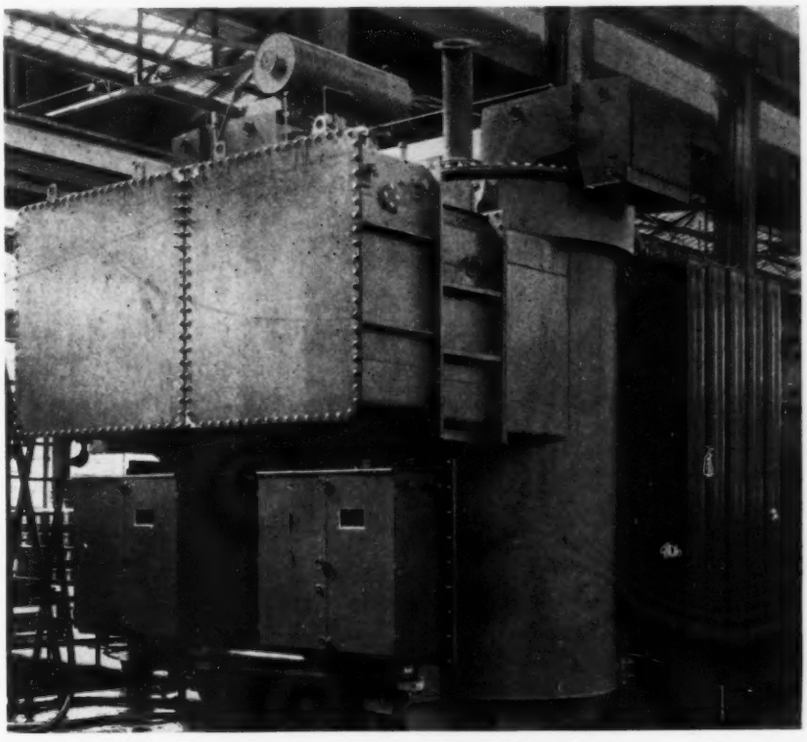

Fig. 3—These tap-changer regulators control both phase angle and voltage in one mechanism

One of a Series of Intimate Talks with Industry Executives

Build on the Rock, Says Tidd

An Interview by
EARL WHITEHORNE

IN A world full of jitters, the last national convention of the power industry paused to glorify the homely virtues of good housekeeping. Philip Sporn, the chief engineer of the American Gas & Electric Company, stood before a great room full of utility executives and engineers and discussed the details of system maintenance and improvement.

Four years ago they wouldn't have listened, for he never mentioned a million dollars. Rather he told how one group of operating companies had gone right ahead with their knitting, despite depression, and kept in step with progress. The rest of the industry, meanwhile—all but a few—had quit all spending. With engineering staffs cut to the bone, they had suspended research, development and improvement, waiting till the clouds roll by. But here was an organization that had not been afraid.

But there was no surprise in it. American Gas & Electric has always been that way—because George N. Tidd is that way. And a talk with Tidd about the electric power business is as stimulating as his company's message at Atlantic City. His whole philosophy is rooted in the simple fundamentals. And the success of this utility system he has been running for the last score years has come in no small measure because this man has planted his feet so firmly on the realities of the day's work. And with this as a basis, he refuses to doubt the days to come.

When I asked Mr. Tidd what he sees ahead for the power companies that has justified continued spending for field studies, apparatus design and new equipment, when so many executives have hardened their hearts against the aspirations of their engineers, his answer was refreshing. "We have built this system," he said, "on the rock of sound operating. The local company was our first love and our ambition and our pride are centered there. We didn't know the depression was coming, but we had planned our work that way and we kept on, believing that the reliability of our service in every town is our greatest resource at all times.

"We run our system like an operating company," he continued. "The officers of our subsidiary companies are the officers of the parent company. The holding company is not the master of the local company, but the servant. The parent company maintains general offices and a technical staff to serve the operating properties, but all work is done at cost. We have paid full price for all stocks and bonds that we have purchased from subsidiaries, but if we make a profit on them, it goes back to the local company. Losses we take. We have no outside interests. We don't think first as financiers. We are operating men.

"Through the years we have built up our properties to be efficient in operation by the steady and persistent improvement of our methods and equipment and by developing mass production economies through interconnection. And we have made them financially strong by building up their resources instead of the holding company's. We have built sound public relations by running our local offices like a corner grocery store. We take care of the operating company, the holding company takes care of itself."

And so when hard times came knocking at the door George Tidd continued building on the rock. "It just seemed to be the thing to do," he said. "And because there was no need to build the system larger, we built it stronger. We studied plant operation for better reliability and for economies and savings. We studied lightning and buttressed against it. We added more loops on our transmission system, reducing the length of transmission, to average 40 to 50 miles. We found out how to build lines for less money and how to provide larger capacity services and improved metering at a lower cost.

"Automatic operation of stations was extended. We helped in the development of high-speed circuit breakers and developed and installed newer and faster relaying schemes, and in doing this improved our service and cut our costs of maintenance. We studied paints and ran exhaustive tests and found out how to make them last longer and provide better protection, and painting costs us more than $100,000 a year.

"And so, little by little, in ways just mentioned and in many others, we consolidated and brought better balance to the system, improved operating practices and service reliability, found new economies, some large and many of them small, in a way not possible when the pressure of expansion was on. Last year we retired from capital account $4,000,000 of inadequate or obsolete plants and equipment. Some years retirement has equaled the new capital investment."

But George Tidd's rock is broader than that. He has had a consistent policy of load building also, a steady drive on the domestic, commercial and industrial markets, year in and out, that has written a fine record of growth. "The future of the power companies will depend on two things," he summed it up, "the reliability and popularity of the local service. The cost of operation, management and money must all be held down. But many costs are now out of our control and can only be carried by more revenue from present consumers. The hope of the future, therefore, lies in growth of load."

Which, I take it, is George Tidd's very practical philosophy boiled down. There lies the rock.

GEORGE N. TIDD, president of the American Gas & Electric Company, a sturdy, vigorous executive, who has built a great interconnected utility system on the fundamental of good local operating. Independent in thought and action, he has continued to push forward his program of engineering progress and load development despite the times.

ELECTRICAL WORLD

L. W. W. MORROW · EDITOR

PUBLISHED EVERY OTHER SATURDAY BY
McGRAW-HILL PUBLISHING COMPANY, INC.

VOLUME 104 ESTABLISHED 1874 NUMBER 12

OCTOBER 13, 1934

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Eyesight Specialists to Prescribe Lighting

THIS coming year has rosier prospects for extensive improvement in illumination in home, office and factory than any previous period. How can that be with many businesses still below par in activity and income? It isn't merely the "new approach" which makes lighting prospects sell themselves on better illumination, as valuable as that new selling tool is. Instead, it is the broadened support which "Better Sight" has developed among other industries and professions—notably the optical profession.

For years eye specialists have prescribed near-vision glasses only to find a large portion of their patients returning with complaints about their difficulty in seeing with the new glasses. Seldom could the complaints be removed as repeated tests proved the eye correction had been right. As a result the patients shifted their patronage only to find no relief from eye discomfort, because light for seeing was inadequate.

In co-operation with optical specialists there has been developed a controllable light source with a constant field of 2 to 200 ft.-candles without change of color temperature and having an attachment for securing approximate daylight from "Mazda" lamps. Supplementing this is an examination kit composed of a special "sight meter" and a series of visual tasks so that eyesight specialists can select that which most nearly duplicates the patient's average needs. After the minimum lighting requirements of the patient, based on his average seeing task, is determined by the specialist, he provides the patient with a special form on which are noted the minimum intensities under which he should work with comfort and safety. A simple means of checking his lighting conditions is also provided the patient.

When light is prescribed in this way, we may expect 20,000 eye specialists recommending what persons directly interested in lighting equipment or electricity have claimed before but who have seldom been heeded. But when a person has his optical specialist tell him certain illumination conditions are essential to his eye comfort, safety and physical, mental and psychological well-being he is going to believe it. And the result will be seen in every home, office and factory; we hope on streets too.

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American Engineering Council —An Embassy

IN THIS period of change few realize the importance of the engineering influence exerted upon national affairs by the American Engineering Council. Quietly, but effectively, it is serving the public and the profession.

It aids federal agencies in selecting engineers for government work. It helps committees survey and investigate situations that call for engineering competency. It suggests changes and improvements in departmental organization. It conveys news of happenings and proposals to the profession. It serves as a rallying point for focussing engineering influence and information. By thorough work and unselfish service American Engineering Council has established itself on a high plane in Washington.

But the full value of the council has not been had because of lack of support by the profession. This has come about because the engineers have not known about the work done and have not supplied sufficient funds to make the council most effective. This situation is now changing. Policies have been introduced that will improve its work and also enable it to tell the profession about its plans and activities. This is a step in the right direction, for as time goes on the necessity for this engineering cornerstone in Washington will increase. Full support, therefore, should be given to the council in its praiseworthy efforts to aid the profession. Its opportunities for service are legion. Its field of activity is almost unlimited.

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Aging Steam Units vs. Future Loads

FOOD for thought may be found in the increasing age of many steam-driven generating units. Because many plants are underloaded under present conditions, it is natural to concentrate attention upon boilers and their major auxiliaries, permitting turbine units to grow old with too little critical study of their fitness for economical future service. Inspection and periodic maintenance, however conscientiously done, are not the whole story.

An examination of the prime mover units in three central stations ranging roughly from 30,000 to 50,000 kva. in rating and generating, in round numbers, between 50,000,000 and 100,000,000 kw.-hr. each in 1933.

showed that of the thirteen generating sets installed and available for service in these plants, seven were put in after the World War. Two were pre-war and only three were installed after 1924. One plant's peak exceeded the rating of its units last winter by 1,300 kw., and purchased energy made up the difference between forced output and peak. The others had margins of roughly 50 per cent above the peak and were not in danger of early overloading, but the relation between age of equipment and fuel consumed arouses inquiry.

Weighted average age of steam turbo-generators in the most economical station was 8.22 years and the average coal consumption for 1933 was 1.21 lb. per kilowatt-hour. The next station, with 9.34 years weighted age of prime movers and generators, used 1.61 lb., and the third plant, 13.3 years old as to these units, consumed 1.77 lb. Obviously it would be hasty to suggest any direct functional relationship between these averages and the over-all yearly economy in fuel consumption because of the manifold factors entering into such figures. At the same time, aging units undoubtedly affect economy in the wrong direction, and as each of these plants burned from a third to half a million dollars worth of coal annually, efficient service of prime movers is a desirable objective. Without losing sight of the imperative need of boiler room economy, a major objective of long standing in steam plant practice, it may be urged that the time is ripe to analyze prime mover conditions for the "long pull."

Interconnection should not be permitted to lull the operating engineer and executive into the opinion that as long as the more efficient units are used in handling daily loads, the older ones can be carried on the side lines as extras without serious study of their future fitness. Where such studies are complete and up to date prompt decisions of great economic value can be made as to plant modernization well in advance of peaks which today seem remote to near-sighted managements.

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Added Capacity from Installed Transformers

SEVERAL utilities are attempting to get more out of transformers by use of expedients to hold down temperatures. One increased the capacity of a large bank 30 per cent by lowering the original cooling coils and adding additional coils to the top of the tank. The cost of the added capacity was about 50 cents a kilowatt. Others are using air blast and other supplementary cooling devices, and still others are running tests to see what normal and temporary loads may be carried without exceeding temperature limits. It is also a more frequent practice to have exterior oil cooling and forced air and oil circulation. All these efforts may be justifiable and safe, but they should be used with caution on present designs.

There is a very decided time element in oil circulation in transformer coils and it is the hot spots that cause breakdowns. Until designs are made that permit of fast and free circulation of oil or air where the heat is generated it is not good practice to take chances by expediency operations of transformers above manufacturers' ratings. Possibly manufacturers would do well to look into changed design and construction elements of transformers, however, to permit of forced convection cooling at high rates.

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The Man for the Job

NO SMALL part of the load-building job which power companies are now facing so frankly will rest upon the selection of personnel. There are two things to be accomplished. Larger revenues must be developed from connected customers—20,000,000 of them being domestic consumers. A more favorable public sentiment must be created. And this will follow naturally with the greater enjoyment of electric service. It becomes of vital importance, therefore, that every official, department head and employee of the company whose work involves any public contacts or reflects on the service should be right in attitude.

This has not always been given the attention that it should receive. Too often there is a man in the organization to be taken care of and he is made a district manager when an opening comes. Or, a meter department head, with a public-be-damned grouch, may be humored because he is such a good meter superintendent. But the day is gone when it is enough for a man to just carry out his function in the organization. He must do his part also in the bigger job of rebuilding prosperity for the company by making friends for the power industry and helping put more load on the lines.

A good meter superintendent can also be a good public relations man if it is required of him. And a district manager can be intelligently selected by writing down the requirements of the job and the characteristics of the man who will best fit it and then finding that man. Men should be found for jobs rather than jobs for men, and the first responsibility should be to the customer and the public—for these are public service corporations.

It was discovered the other day that the local manager in one small city, as one of many small economies, had resigned from the Chamber of Commerce. His company was no longer a member. The public utility was no longer in the picture in local affairs. That manager had simply lost sight of his public responsibility, and with that outlook is powerless to do his real job. To correct such conditions it would be well for every company to analyze systematically each job and the man now in it, to locate the misfits and make these broader objectives plain to all.

P.W.A. Limits Loans to Municipalities

Secretary Ickes restates policies governing administration's loans for power projects—Urges continuation of P.W.A.

"Municipal or local publicly owned power projects will be aided by P.W.A. only when, in addition to meeting those qualifications necessary for public works projects, they assure electricity to communities at rates substantially lower than otherwise obtainable," Public Works Administrator Ickes announced last week in a restatement of loan policies. The announcement asserted that the administration's basic policy was unchanged.

This announcement was made, officials stated, following action by some privately owned utilities which found it possible to reduce rates to a point below those proposed by municipal project plants. "To make loans and grants," the statement says, "to finance projects where the competitor offers rates which are lower than those possible by the city plant would duplicate facilities without any social betterment and impose on the city a burden which it probably could not meet without resort to taxation."

Administrator Ickes expressed the belief recently that public works program should be carried on on a substantial scale by appropriation from the next Congress. "I think the public works program has more than justified itself and that we ought to go ahead with it until we are out of the depression, being prepared, however, to slacken up whenever private industry can provide employment," he said.

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Los Angeles Votes Approval of Utility Acquisition

By a vote of 112,070 to 78,824 citizens of Los Angeles, Calif., at a special election held September 27 authorized the Los Angeles Department of Water and Power to borrow money from the state or federal government to acquire the electric properties of the Los Angeles Gas & Electric Corporation. Voters also indicated their approval of the department's taking over a part of the outstanding bonded indebtedness of the corporation and retaining all employees in their respective capacities without regard to civil service requirements.

Among the other proposed amendments affecting the operation of the Department of Water and Power which were carried was one to permit the sale of excess power from Boulder Dam to private power companies in the first four years after completion of the project, when such excess is expected to prevail.

The voters, however, registered a surprise defeat of a measure providing for the granting of 40-year franchises to gas companies. The unexpected defeat of the proposal developed confusion as to future operations of the Los Angeles Gas & Electric Corporation, serving the Los Angeles area.

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Seattle Seeks to Acquire Puget Sound Company

Plans for a far-reaching power deal in which the entire system of the Puget Sound Power & Light Company would be acquired by Seattle's municipal lighting department was presented last week to the City Council by J. D. Ross, City Light superintendent. The proposal calls for the purchase of all Puget Sound properties in western Washington and at Rock Island in the Columbia River in eastern Washington for $95,000,000.

The deal would be financed by the issuance of 30-year City Light utility bonds at 5 per cent interest, to be retired solely from earnings of the plants purchased. Under the Ross plan City Light would extend its service throughout the vast territory now served by the private company. Cities, towns and power districts would have the privilege of purchasing at cost value parts of the system lying within their own limits. They would buy their current either from the Seattle system or the private company or generate it themselves.

Under existing laws City Light cannot sell its current inside the corporate limits of other municipalities. The Bone power bill, passed by the last Legislature, subject to approval of the voters at the election November 6, would break down this barrier. The magnitude of the new plan involves 43 of the private company's properties, showing a plant value of approximately $128,000,000.

Frank McLaughlin, president of the Puget Sound company, professed ignorance of the Ross plan and added that he would make no comment until the proposal is submitted to the company. No comments on the plan were available at the headquarters of Engineers Public Service Company, which controls the Puget Sound Power & Light Company.

Grange Bill Void

Superior Court Judge rules act unconstitutional—Delays the Lincoln County power district, opposed by utility

The Grange District power bill, a public ownership measure enacted into law by initiative last November, is unconstitutional, according to an opinion handed down last week by Judge C. G. Jeffers in Superior Court at Davenport, Wash. Judge Jeffers' decision was based on the ground that property owners were not provided with an opportunity of expressing their wishes as to having their property included in the public utility districts.

The ruling prevents—unless the Supreme Court should rule otherwise—putting the question of forming a power district in Lincoln County before the voters in November. The judge overruled a demurrer by the county commissioners against the injunction sought by the Washington Water Power Company, Great Northern Railway Company and the Northern Pacific Railway Company to prevent the question from going on the ballot (ELECTRICAL WORLD, September 29, page 45).

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Portland Utility Files Bankruptcy Petition

Acting under the national bankruptcy act as amended last June, the Portland Electric Power Company has filed a petition in bankruptcy. Federal Judge McNary dissolved the receivership under which the company has been operating since last March and set October 22 for a hearing. The effect of this court action is to permit the company to continue its reorganization proposed at the time the temporary receivership was established. Seventy-two per cent of the outstanding original debentures have been offered for exchange.

Simultaneously with the dissolution of Portland Electric Power Company's receivership, Franklin T. Griffith, president, addressed a communication to holders of $40,000,000 of 4½ per cent first and refunding mortgage bonds of Portland General Electric Company, Portland Electric Power's chief subsidiary, asking a waiver in the trust indenture behind those bonds of the provision for the prompt payment on maturity of a $6,500,000 senior issue of first mortgage 5 per cent bonds due July 1, 1935. An extension of ten to fifteen years in maturity date of the issue is sought.

Utilities Plan Vigorous Defense

Empire State Association hears new ideas for utility defense and for business expansion — Positive action suggested by McCarter — Old age retirement reserves discussed by H. C. Hasbrouck

Last week the Empire State Gas and Electric Association had a good meeting in Rye, N. Y. A large attendance and a good program made this a very successful and stimulating convention.

In a stirring address Thomas N. McCarter gave some highlights on present conditions. He was disappointed with the last radio talk of the President because it said nothing about balancing the budget, returning to the gold standard, stopping prodigal expenditures and ceasing to compete with business. And with reference to the utility business, he said the attacks upon it have been colossal and cover three aspects.

McCarter discusses utility burdens

The first is the enormous and discriminatory taxes placed upon it by federal and local authorities. These taxes seem based upon the premise of "soak the utilities" only. The second aspect is that along with greater taxes is the demand to lower rates, particularly domestic. This demand is absolutely unsound and, so far as the public is concerned, is an ignorant demand. In the opinion of Mr. McCarter, if there is any class of business in which rates should not be lowered it is the domestic. Yet all the uproar is about domestic rates, about 10 cents a day that his customers pay for service, convenience and comfort. "The whole thing is artificially stimulated political buncombe." And now there is the foolish idea of the "temporary rate." The case is decided before the day in court without regard to facts or fairness. This idea is unsound and unreasonable.

The third aspect is the spending of federal money for unfair and competitive federal and municipal projects. The federal government has committed itself to spend about a billion dollars of taxpayers' money on its own projects. It gives 30 per cent of the money from taxpayers to install competing municipal plants. Yet private utilities pay taxes for support and then competition. Is this a square deal or a fair proposition?

And in all these cases there is already an excess of power. If these enterprises are carried out it means ruin to somebody—to taxpayers, to utility investors or to both. It seems to Mr. McCarter that the "forgotten men" today are the millions of investors in the private utility industry. And yet Title I, Sec. 1 of the new deal act says "to eliminate unfair competitive practices and to secure the utmost utilization of the present productive capacity of industry."

Happily the situation is arousing the people of the country, said Mr. McCarter. He believes the attack has reached its apex and a strong public sentiment is growing outside the private utility industry to check further action. So there is hope. It is evidence of a strong and sound foundation that the industry has survived this colossal attack. In conclusion, Mr. McCarter said: "I do not believe in any policy of propaganda, but I do believe that the time has come for utility men to stand up and be counted. I do believe that self-preservation is the first law of nature. I also believe that what is to be done must be done politely, tactfully and ethically. I propose a vigorous and an effective defense of this industry from now on."

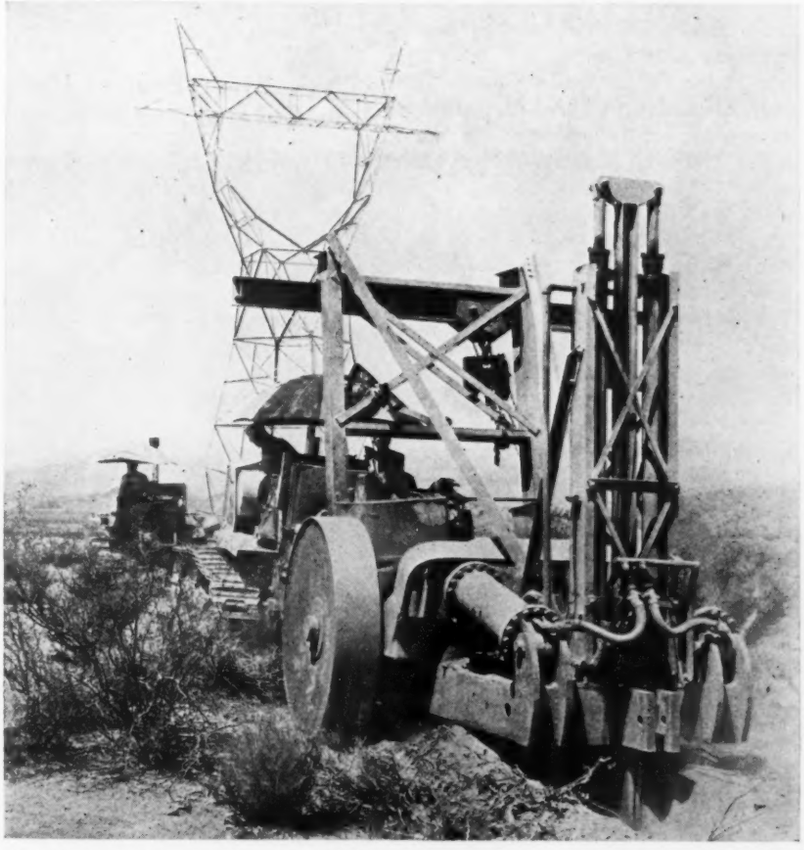
In a fine paper H. C. Hasbrouck discussed unemployment reserves and old-age retirement reserves for the utility business. He believed these steps would be legislated and suggested a voluntary development of the principle. Both reserves are admittedly palliatives only. Under stable conditions in the utility industry a sample cost figure is about 5 per cent of the payroll for unemployment reserves and from 10 to 15 per cent for old-age retirement reserves.

Adequate highway lighting urged

The urgent need for highway and street lighting improvement was presented by Dudley Diggs of the General Electric Company, who presented a study of the appalling losses now resulting from automobile accidents. The association will consider the appointment of a joint committee to co-operate with the manufacturers and insurance companies to work out a program for coping with the problem in New York State.

A. E. Allen, vice-president of the Westinghouse Electric & Manufacturing Company, discussed the dual responsibility of the utility and manufacturer in

COUNTERPOISE PLOW FOR BOULDER DAM LINE



Specially designed plow for laying counterpoise wire along the 270-mile Boulder Dam transmission line project now under construction being towed by two type 70 tractors. Fabricated with the co-operation of the engineers of the Los Angeles Bureau of Power & Light, it weighs 8 tons when loaded with reel which carries from 4,000 to 5,000 ft. of wire. It lays an average of 1½ miles of wire per hour and operates successfully in sand, hard-pan, shale and extremely rocky terrain.

the development of the range and water heater market to that point where public demand creates a volume that will support the dealer as an active influence for load building.

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Utilities Section Meets at Annual Safety Congress

Two sessions were held by the public utilities section at the twenty-third annual Safety Congress and Exposition at Cleveland, October 1-5. The program for the first day included opening remarks by the general chairman, F. M. Pepper of the Illinois Bell Telephone Company, Chicago; an address of welcome by C. E. Gallagher, president of the East Ohio Gas Company, Cleveland, and an address on "Electrical Shock and Its Effect," by W. B. Kouwenhoven, assistant dean of the school of engineering, Johns Hopkins University. A large part of the meeting was spent in open discussion, covering safety progress in the utilities field during the past year.

At the second session F. M. Pepper, chairman, talked on "What Lies Ahead" and he was followed by H. F. Webb, general safety director of the West Penn Electric Company, who gave a dramatized version of "Behind the Scenes," involving safety work. "Fire Prevention in the Public Utility Industry" was ably discussed by T. Alfred Fleming, supervisor of the conservation department, National Board of Fire Underwriters, New York. The other featured address of the final meeting of the public utilities section was given by H. D. Bender, engineer in the outside plant development department of the Bell Telephone Laboratories, Inc., New York, on the subject "Development and Research and Their Relation to Accident Prevention."

Five cardinal points must be considered for safe maintenance work on industrial electrical equipment, J. D. Donovan, superintendent of maintenance, central alloy district, Republic Steel Corporation, Massillon, Ohio, told the congress, while speaking on the "Safe Use of Electricity in Industry." He said in part: "Effective accident prevention work when handling industrial electrical equipment depends on (1) good and approved equipment; (2) proper installation; (3) correct safeguarding; (4) good repair tools and equipment; (5) high type of men; (6) proper safety education.

E. J. Kreh, formerly vice-chairman for gas interests, was named general chairman of the public utilities section; John J. Barada of the Laclede Gas Light Company was named vice-chairman and Henry Luech of the Commonwealth Edison Company was elected secretary of the group.

Trade Commission Probes Utility Property Transfers

Continuing its investigation of the Associated Gas & Electric System (ELECTRICAL WORLD, September 29, page 46) the Federal Trade Commission heard William J. Warmack, commission examiner, testify at a recent hearing that the Associated system materially weakened the structure of the General Gas & Electric Company through transferring its principal earning properties in 1929 to other Associated subholding companies. Securities worth $20,000,000 in four companies, Mr. Warmack stated, were exchanged for stocks valued at $57,000,000 in other Associated companies, with the result that assets in both Associated and General Gas were inflated $45,000,000.

The four companies named were Metropolitan Edison, New Jersey Power & Light, Binghamton Light, Heat & Power and Northern Pennsylvania Power. W. A. Hill, Associated counsel, charged that Mr. Warmack arbitrarily fixed the book value of securities involved as the basis of the original cost of the fixed assets behind the securities. He stated that Associated actually put $16,000,000 into support of the General Gas securities in 1929.

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New River Project Upheld in Government Suit

Dismissal of the federal government's suit to halt construction of the power project on the New River (ELECTRICAL WORLD, June 23, page 923) has been asked by the Electro-Metallurgical Company on the grounds the stream is not navigable and the federal water power act is unconstitutional in so far as it applies to non-navigable streams. The Metallurgical company, which planned to utilize the power of the hydro-electric project at Hawks Nest, and the New Kanawha Power Company and Union Carbide & Carbon Corporation joined in the answer to the government's suit in the United States District Court at Charleston, W. Va.

The Department of Justice, at the time the suit was filed by the federal government last June, termed it a direct assertion of the government's right to control the stream flow of navigable rivers. It also asserted that the project was "without lawful authority" because it was licensed only by the state and not by the Federal Power Commission or any federal agency.

The companies quote a report of the chief engineer in December, 1932, that "the project at Hawks Nest if operated as proposed by the company primarily to carry a base load will have practically no effect on navigation of the Kanawha River." "If the federal water power act," the petition reads, "be construed to confer jurisdiction upon the Federal Power Commission to issue, and to subject a hydro-electric project situated on a non-navigable stream and not involving the use of any land or other property of the United States to the provisions of a license conditions other than those relating solely to the protection of the United States in its navigable waters, then said act is to that extent unconstitutional."

The companies declare, furthermore, that they acted upon the Federal Power Commission's permission to withdraw the declaration of intention in proceeding with construction under a license granted by the state Public Service Commission, adding that with huge sums of money already expended the federal government is without the right to halt construction.

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Utility Plan Hearing Set

Announcement has been made that a hearing would be held by the United States District Court on December 4 in New York on a plan of reorganization for the Central States Edison Company filed under Section 77-B of the bankruptcy act. In order to participate in any plan, claims and interest of security holders, creditors and claimants must be filed by November 15. Under the company's plan, holders of first lien 5½ per cent bonds due in 1943 will receive for each $1,000 principal amount $500 face value of new fifteen-year collateral trust bonds and 50 shares of capital stock, and holders of 6 per cent debentures due in 1949 will receive for each $1,000 principal amount twenty shares of capital stock. Stockholders do not participate in the plan.

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Cities Seek Modification of Boulder Dam Contracts

Application has been made to Secretary of the Interior Harold Ickes by the city of Pasadena, Calif., for modification of its contract with the federal government concerning the purchase of power to be generated at the Boulder Dam. C. W. Koiner, Pasadena city manager, announced that he had requested the Interior Department to grant Pasadena a three-year load building period and not to require the city to take 68,000,000 kw.-hr. as soon as the power is made available for transmission. The cities of Glendale and Burbank, Calif., likewise have asked for modification of their contracts with the government for Boulder Dam power. Glendale has requested five years in which to take its maximum amount of new energy, while Burbank has asked for seven years time from the date power is available for delivery.

Illumination to Be Prescribed by Optical Profession

I. E. S. convention most inspiring in years — Talk seeing instead of light — Demonstrational approach great aid — Deplorable conditions in schools, industry and on streets — Which activities pay?

More inspiration came out of the Illuminating Engineering Society convention held in Baltimore October 1 to 4 than from any previous convention within recall. It is difficult to lay a finger on any single source of enthusiasm, but the National Illumination Conference (lighting salesmen), on the first day, holds first place.

The whole tone of the convention and exhibitors was different than in former years. While a professional convention could not ignore technicalities, all discussions hinged on how to secure better seeing in daily tasks rather than on abstract light and illumination. And the encouraging situation is that new selling tools (demonstrational procedures) are available which make the customer sell himself and stay sold on better illumination. The only weak link seen by several speakers is that manufacturers and distributors must be aided in helping the customer select the right equipment for the seeing task.

More than lighting people are now behind better lighting because better sight has been selected as the aim. With the slogan "Eyes + correction where needed + adequate light properly shaded and directed + proper reflecting surfaces on walls and ceilings = Better Seeing" a broad interest has been created. Backing it are the optical profession and industry, lighting equipment manufacturers and utilities, auxiliary equipment manufacturers and distributors, and paint and wall paper industries.

Standing head and shoulders above every other influence is the attitude that is rapidly consolidating among members of the optical profession. They have long had complaints from many patients after fitting them with glasses, and could not satisfy many. Now the profession is recognizing that adequate illumination must supplement glasses, according to M. J. Julian, president of the Better Vision Institute. It is not passive recognition, as Earl L. Canfield pointed out. In the near future optical specialists will *prescribe illumination* for each patient's usual tasks in addition to prescribing glasses. This will be made possible by equipping the optical profession with controllable illumination intensities of 2 to 200 ft.-candles without change of color temperature, a constant field, color filters for securing approximate daylight from "Mazda" lamps, and what is called "visulite technique" for testing eyes and prescribing illumination.

I. E. S. certified portable lamps, which were stimulated as a result of conditions found among students, are expected to find a broad appeal in the home where both utilitarian and esthetic values are required. Prof. H. B. Dates referred to a survey of 252 schools, where 40 per cent of the students were found to have defective eyesight. Still there are restrictions on the wattage which can be used in many college dormitories. In 85 per cent of the schools there is less than the recommended 12 ft.-candles. One school, ideal in every other detail including air conditioning, had only 1½ ft.-candles. A small community leads the country with 40 ft.-candles in classrooms. Tests in a Pennsylvania school demonstrated a 28 per cent increase in student achievement by raising the illumination to 12 ft.-candles.

Inadequacy of illumination in the industrial field was brought out by Charles Poey, N. Y. & Queens Light & Power Company, and by Professor Dates. They reported that a survey of 1,249 cities in 46 states shows that industries having the greatest activity have the best lighting and that low activity is associated with obsolete lighting. Twelve per cent of the plants studied have improved illumination recently. Fifty-four per cent of all plants use obsolete reflecting equipment, more than eight years old, and the average intensity on working areas is only 2.9 ft.-candles.

It was recommended by several speakers that every one join hands in seeking the best lighting solution for each poorly lighted industry so that the plans can be presented to the national organizations of those industries. These plants include metal working, paints and varnish, building materials, chemical manufacturers, refining, rubber, shoe and woodworking.

Taxpayers pay for good street lighting whether they have it or not, reported R. E. Simpson, National Bureau of Casualty & Surety Underwriters. One city increased its street lighting budget 11 per cent (9 cents per capita) and experienced a 25 per cent reduction in night fatalities or an economic saving of

"COMFORT METER" INDICATES AIR CHARACTER

At a recent meeting of the Electrical Association of New York Dr. E. E. Free demonstrated the Eupatheoscope, a recent invention by the British government scientists to determine the character of the air in a room

$2.07 per capita. Whereas another city reduced its budget 14 per cent (19 cents per capita) and increased night fatalities 7.6 per cent—an economic loss of 69 cents per capita. In 1933 the per capita cost for street lighting of cities having nearly 32,000,000 inhabitants averaged $0.94 and the excess economic loss was $1.07 compared with 1932, when the per capita lighting cost was $1.09 and the excess economic loss $0.93.

Managements are now trying to find out just what activities should be accentuated and which should be curtailed. H. H. Balkam, Brooklyn Edison, declared this has to be determined by comparing cost with return. While the "new approach" promises attractive results, facts must be obtained. He explained three methods used by his company and cited some intriguing results.

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Lower Voltage Trend in Welding Revealed

Advantages of lower open circuit voltages discussed before American Welding Society in New York

One of the trends disclosed at the recent fall meetings of the American Welding Society in New York is that toward lower open circuit voltages for welding apparatus. H. S. Hubbard of Pittsfield, in discussing the paper by A. M. Candy of East Pittsburgh, said it would help greatly if the field could indicate how much of the open circuit voltage is required for starting and how much for margin of stability. Voltages of 80 or over 65, as compared with the prevailing 100 or more, would contribute materially to cost reduction and improvement in power factors and efficiencies.

Another discussor asserted that the stability with 75 volts a.c. using reactance control is superior to that of d.c. when the arc is short circuited momentarily by formation of a globule. E. L. Hanson in upholding d.c. welding countered that a.c. welding seemed to require repeated stimuli to keep it from receding after every advance. There seemed to be no dissent that a.c. welding is holding its own as shop equipment, especially in conjunction with welding heads. O. A. Tilton cited the experience of Foster Wheeler Corporation in fabricating large pressure vessels as high as 14 ft. diameter and 70 ft. long. Tests with the General Electric 300-kv. X-ray equipment had disclosed only 0.04 per cent of defects. The conclusion there had been that when defective grooving is fully overcome machine welding will have become a perfect process.

A symposium on qualification of welding operators brought from several large concerns the report that they were disturbed by the costs incurred through multiplicity of personnel tests imposed by different regulatory and inspection bodies. There was manifested a need for a uniform qualification test to be applied by a single agency.

It should be confined to the largest or average size of electrode employed in downward, vertical and overhead welding. Further, the tests should be repeated only on lapse of employment or when inferior work is suspected or detected.

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Diablo Contract Forfeited

Because the Henrikson-Alstrom Construction Company alleged a mistake had been made in figuring its estimate and because the company could not secure a performance bond, the Board of Public Works, Seattle, forfeited the company's bid bond and decided to call for new bids for the construction of the Diablo power house, tailrace and appurtenances. The Henrikson-Alstrom Construction Company's bid for this completed job was $267,298 (ELECTRICAL WORLD, September 29, page 44).

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SODIUM LAMP TRIED OUT IN LIGHTHOUSE

Lighthouse Service of the U. S. Department of Commerce has purchased the necessary lamps and equipment and is trying out a sodium lamp installation in the Cape May Lighthouse at Cape May Point, N. J. In this test all equipment has been supplied by the General Electric Company.

Scientists Discuss Rare Metal Uses

Electrochemical meeting brings out new data — Solid photo-electric cell theory — Better control of furnaces

The Electrochemical Society met in New York September 27-29. A large attendance and a good program made it a very successful meeting. An interesting group of papers dealt with the characteristics of the rare metals such at titanium, vanadium, thorium, uranium and europium. These rare metals have a small market as yet, but it is growing. Some of them have very valuable electrical characteristics, for example barium as an electron source, and others for radiation effects.

Another session was devoted to the physics of electrodeposition and brought out new theories and new developments. A new technique uses radiation electronic and ionic activity for measurement. As usual, metal corrosion was discussed and the two preventive measures, one a coating, the other the production of noncorrosive forms of metal.

A fundamental research on the solid photoelectric cell showed that both the theory and the mechanism of action were still unknown. The research supported the quantum theory as against the wave theory, but so many variables exist that positive conclusions are difficult to make. Another interesting paper showed that the use of a small amount of barium flux in electric furnaces had a very stabilizing effect on the arc.

Visits to industrial plants, a banquet and dance and a luncheon addressed by Dr. O. H. Caldwell, Dr. F. B. Jewett and others rounded out one of the most successful meetings of the society held in recent years.

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NRA Reactions Sought in N.E.M.A. Survey

Completing a year's operation under NRA codes, the National Electrical Manufacturers Association has started a survey among 1,200 producers of electrical appliances and equipment to get their reaction to the recovery program in general and its effects upon the electrical industry in particular. Foremost among the questions asked is whether producers favor continuance of the NRA with or without modifications. Those favoring changes are asked to specify in what manner the recovery program should be altered. Questions confined to the electrical industry's own codes seek comment on the value of the published price filing provisions and reports on the changes in employment and profits which have occurred as a result of the code regulations.

T.V.A.—Knoxville Contract Fought at Commission Hearings

Preferred-stock holders of Tennessee Public Service Company oppose deal as unconstitutional — Hearing set on Alabama transfer — Memphis to vote on T.V.A. power at the November election

Consummation of the contract under which the Tennessee Valley Authority would purchase the electrical properties of the Tennessee Public Service Company in and near Knoxville has been postponed indefinitely by impending litigation resulting from the opposition of a group of preferred-stock holders of the utility company. When the plan was recently submitted to the state Railroad and Public Utilities Commission for approval, preferred-stock holders of the Tennessee Public Service Company, together with thirteen ice and coal companies, filed intervening petitions with the commission, objecting to the contract in spite of the fact that at a meeting of the stockholders of the Tennessee company called to ratify the plan no dissenting opinion was expressed by these preferred-stock holders who have voting powers.

At the hearings held last week and early this week before the commission, Forney Johnston, a Birmingham attorney, appearing on behalf of the opponents of the plan, attacked the transaction as unconstitutional, charging that the T.V.A. was attempting "to saddle its mistakes on the state as a part of its guinea-pig experiment on the people of Tennessee." James L. Fly and William C. Fitts, Jr., attorneys for the T.V.A., argued that matter of "unconstitutionality and legality" was outside the commission's jurisdiction, and that if the petitioners had suffered injury they could seek redress in the courts. R. W. Lamar, vice-president and general manager of Tennessee Public Service, appearing before the commission, testified that under all circumstances approval should be given to the contract.

Attorneys representing the preferred-stock holders also filed a bill in United States District Court in Knoxville asking an injunction against the Tennessee Valley Authority and the Tennessee Public Service Commission to keep the T.V.A. from buying the holdings of the corporation.

The hearing of the Alabama Public Service Commission on the petition of the Alabama Power Company to sell distribution systems in fourteen north Alabama municipalities to the T.V.A. has been postponed until October 23. The Alabama Power Company made the request for postponement at the suggestion of the T.V.A.

Memphis considers power plan

The city of Memphis, Tenn., will vote November 6 on a proposal to issue not more than $9,000,000 of bonds to buy the existing electric power distributing system of the Memphis Power & Light Company or to build competing facilities. If the proposal is approved by the electors, it is planned to use power produced by the Tennessee Valley Authority.

At the suggestion of President Roosevelt members of the New York State Port Authority are now visiting the Tennessee Valley projects, exchanging views with T.V.A. officials. In the party are Frank P. Walsh, chairman of the New York body; James C. Bonbright, professor of finance at Columbia University; Leland Olds, secretary of the Power Authority, and George S. Reed.

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Wire Device Industry Files Supplementary Code

Concerning themselves almost exclusively with maintaining quality standards and eliminating destructive price cutting, proponents of a revised supplemental code for the wiring device industry presented their proposals to Deputy Administrator J. G. Cowling at a recent public hearing in Washington. John C. Dallam of the General Electric Company, Bridgeport, Conn., chairman of the code committee, presented the code and an amendment.

"Destructive competition," Mr. Dallam said, "has prevailed in this subdivision, notwithstanding the fact that our basic code was approved in August, 1933. Price levels have been written down, and it is generally recognized that many are extremely unsatisfactory from an operating point of view. It is hoped that the prompt approval of this supplemental code will assist in placing competition on a fairer basis."

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Bureau of Labor to Take Census of Engineers

As a result of conferences between the American Engineering Council and Dr. Isadore Lubin, director of the Bureau of Labor Statistics of the U. S. Department of Labor, a census of engineers will be undertaken immediately with the purpose of providing a picture of the present economic status of the engineer.

The proposed census would not be a house-to-house canvass, but would be undertaken by a questionnaire which will develop a number of facts concerning employment, compensation and other information of value in establishing the present distribution and employment of engineers. Member organizations of the American Engineering Council will all co-operate with the Department of Labor in making this survey.

EVENTS IN WASHINGTON

An application from the Kanawha Valley Power Company covering an important proposed project just below Winfield on the Kanawha River has been received by the Federal Power Commission. The company proposed to use the head created by the government dam which probably will be built at that point. It would install four generating units, having a total capacity of 26,000 hp. The output would be delivered to the Appalachian Electric Power Company.

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The Supreme Court of the United States has declined to review the case brought by the Arkansas Utilities Company intended to prevent the municipality of Paragould from constructing its own electric power plant. The case brought by the Consumers Power Company of Allegan, Mich., also was denied a Supreme Court review of the action it brought against the issuance by the town of additional bonds for the construction of a municipal power plant.

PAUL WOOTON,
Washington Correspondent.

COMING MEETINGS

National Electrical Wholesalers Association — Hotel Book-Cadillac, Detroit, Mich., October 15-17. E. Donald Tolles, 165 Broadway, New York.

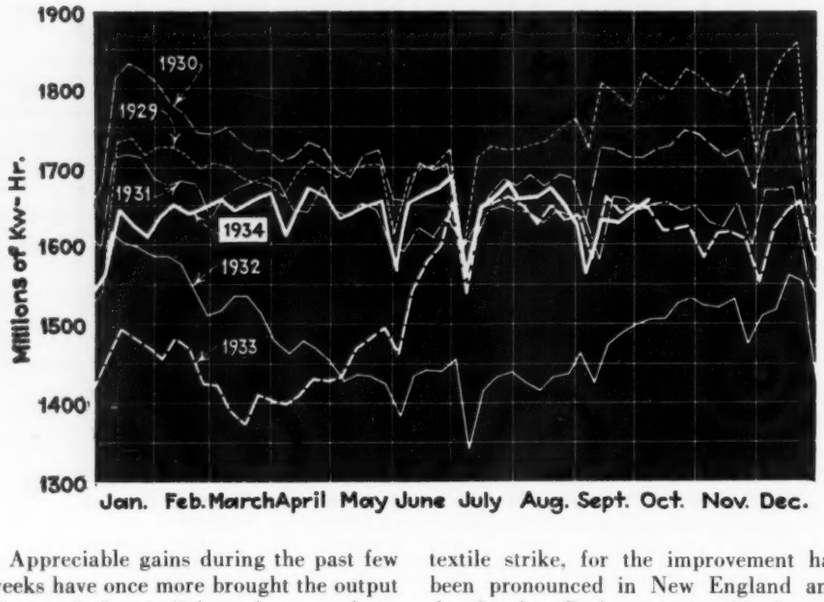
National Electrical Manufacturers Association — Annual Meeting, Chicago, October 17-20. W. J. Donald, 155 East 44th St., New York.

National Association of Railroad and Utilities Commissioners — Annual meeting, Washington, D. C., November 12-15. James B. Walker, 270 Madison Avenue, New York.

American Society of Mechanical Engineers—Annual meeting, New York, N. Y. December 3-8. C. E. Davies, assistant secretary, 29 West 39th St., New York.

American Engineering Council—Annual meeting, Washington, D. C., January 10-12. Frederick M. Feiker, executive secretary, 744 Jackson Place, N.W., Washington, D. C.

Lead Is Regained Over 1933



Appreciable gains during the past few weeks have once more brought the output of central electric light and power plants above last year's figures, after a sag of a month's duration. As announced by the Edison Electric Institute it amounted to 1,659,192,000 kw.-hr. in the week ended October 6, following the 1,648,976,000 kw.-hr. of the preceding week, and rising 0.8 per cent above the production in the corresponding period of 1933. Records for the like season in other years were surpassed with the exception of 1929 and 1930.

It seems clear that the reduction in September was correctly ascribed to the textile strike, for the improvement has been pronounced in New England and the South. Both regions still show a disparity compared with last year, but in New England it is only half as great as it was in mid-September and in the South it dwindled from a maximum of 6.2 per cent to 0.6 per cent. The Central industrial region is catching up, the Rocky Mountain is ahead for the first time since July, the West Central is increasing its gains, the Middle Atlantic and Pacific regions are holding their lead over 1933.

Weekly Output, Millions of Kw.-Hr.

1934		1933		1932	
Oct. 6	1,659	Oct. 7	1,646	Oct. 8	1,506
Sept. 29	1,649	Sept. 30	1,653	Oct. 1	1,499
Sept. 22	1,631	Sept. 23	1,639	Sept. 24	1,491
Sept. 15	1,634	Sept. 16	1,663	Sept. 17	1,476
Sept. 8	1,565	Sept. 9	1,583	Sept. 10	1,424
Sept. 1	1,627	Sept. 2	1,637	Sept. 3	1,465

Per Cent Change from Previous Year

Region	Week ended Oct. 6	Sept. 29	Sept. 22
New England	— 4.6	—5.9	— 8.8
Middle Atlantic	+ 2.0	+2.7	+ 2.9
Central Industrial	— 0.9	—1.9	— 1.9
West Central	+ 6.4	+2.3	+ 3.9
Southern States	— 0.6	—7.4	— 6.2
Rocky Mountain	+ 1.4	—7.4	—11.8
Pacific Coast	+ 7.0	+7.8	+10.5
United States	+ 0.8	—0.2	— 0.5

White River Project Hearing

Hearing will be held November 15 by the Federal Power Commission on the application of the White River Power Company for permit to build a series of three dams with an ultimate capacity of 159,000 hp. on White River, north Arkansas. One of the dams would be located at Wildcat Shoals, 5 miles above Cotter; the second at Bull Shoals and the third at Hog Thief Bend. Preliminary work has been completed at Wildcat Shoals for a dam 83 ft. high, to develop 68,000 hp.

•

Colorado River Bill Fails

To the great surprise of its proponents, the Colorado River Authority bill met with defeat in the closing hour of the recent special session of the Texas Legislature. The bill had for its purpose the completion of the dam and hydro-electric plant on the Colorado River, about 50 miles above Austin, and the placing of the project under state control. Governor Ferguson has announced she will convene the Legislature in another special session and that the subject will again be submitted.

•

Delta-Star Awarded Contract

Contract involving $140,889 has been awarded to the Delta-Star Electric Company of California by the Bureau of Power and Light, Los Angeles, covering sixteen 287,000-volt, 1,200-amp. three-pole motor-operated disconnecting switches for installation on the 275,000-volt, double-circuit transmission line connecting Los Angeles with Boulder Dam. These switches, designed in Chicago, will be manufactured in Los Angeles by Kelman Electric & Manufacturing Company, with which Delta-Star has made manufacturing arrangements for production of Delta-Star designs in the West.

•

Swindle Charges Brought Against Insull at Trial

Trial of Samuel Insull and sixteen co-defendants on charges of using the mails to defraud opened last week in Chicago before Federal Judge James H. Wilkerson. Relying upon entries in hundreds of ledgers and the records of some seventy-five corporations to prove its case, the government outlined its charges against Mr. Insull and his financial associates as a conspiracy in stock manipulation by which the investing public lost a total of $100,000,000.

Dwight H. Green, United States Attorney, contended that the motive in the organization of Corporation Securities Corporation was that the capital structure of Middle West Utilities had to be reorganized in 1929 and the market price of that stock had to be advanced. Therefore, he continued, the Insulls and Halsey, Stuart & Company stepped into the market, advanced the Middle West stock by buying $13,000,000 worth of it, and the price jumped from $150 to $500. Corporation Securities was organized when it became necessary to have a "dumping ground" for this stock, he charged.

Mr. Green explained that with one exception all of the defendants were officers and directors of Corporation Securities. He charged that investing companies, holding companies, operating companies and brokers all were in the scheme. The rest of the week was taken with the presentation of documentary evidence.

Reorganization of nine public utility corporations in the Insull system with assets aggregating several hundred million dollars was asked last week by stockholders and bondholders in petitions filed in United States District Court in Wilmington, Del., under the terms of Section 77B of the federal bankruptcy act. Each asked for the appointment of trustees. The companies included Middle West Utilities Company, Central and Southwest Utilities Company, Central Public Utility Corporation, Electric Public Service Company, Southern Cities Utilities Company, Federal Public Service Corporation and certain telephone companies.

New York Metal Prices

	Sept. 25, 1934 Cents per Pound	Oct. 9, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00
Lead, Am. S. & R. Price	3.60	3.60
Antimony	8.87	9.00
Nickel ingot	35.00	35.00
Zinc, spot	4.35	4.225
Tin, Straits	51.50	50.625
Aluminum, 99 per cent	23.30	23.30

*Blue Eagle.

August Output Exceeded July

Electrical energy output of public utility plants during August, reported by the U. S. Geological Survey as 7,666,000,000 kw.-hr., closely approximated that of the month a year ago and exceeded the amount generated in July by about 1 per cent. The normal change, according to the survey, is an increase of 3 per cent.

The decrease in production from water power which began in May has continued during each month, production in August being about 15 per cent less than a year ago, and dropping to 32 per cent of the total. Energy from fuels increased correspondingly to 5,189,000,000 kw.-hr., the excess over July being 4 per cent, over June 8.5 per cent and over August, 1933, 9 per cent. This was the largest output from fuels since November, 1931.

These statistics include reports from traction and other plants contributing to the public supply as well as central stations for electric light and power. Changes in per cent compared with corresponding months of last year are shown for the various geographic divisions in the accompanying table.

Region	June	July	August
United States	+ 3	+1	0
New England	— 5	—6	— 6
Middle Atlantic	+ 4	+1	— 2
East No. Central	+10	+5	+ 2
West No. Central	— 3	+4	+ 6
South Atlantic	— 3	—1	— 7
East So. Central	—10	—6	— 6
West So. Central	+ 7	+7	+11
Mountain	— 5	—7	—13
Pacific	+ 6	+5	+ 4

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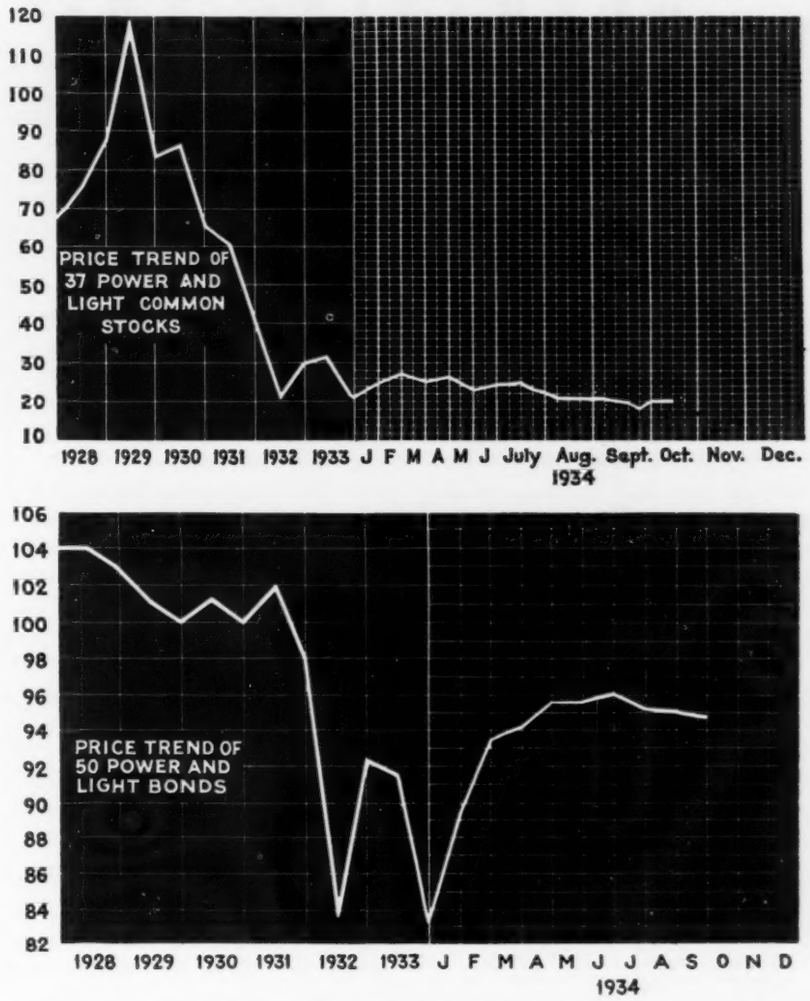
Associated Gas Plan Filed

Tentative plan for reorganization of the Associated Gas & Electric Company, petition for which was made last June by a group of security holders, was submitted this week to Federal Judge Julian W. Mack in New York. The plan provides for the issuance of only one class of stock. It also provides that debentures, issued pursuant to the plan of rearrangement of debt capitalization existing May, 1933, be restored to the status existing prior to the exchange.

Bond Prices Lower; Stocks Advance



High-grade utility bonds showed a slight tendency to decline in September —*Electrical World* index, 94.7; August, 95.1. Few noteworthy changes occurred in the values of electric light and power common stocks this week—*Electrical World* index, 20.3; last week 20.2.

Boston Edison to Retire $20,000,000 Note Issue

Directors of the Edison Electric Illuminating Company of Boston have voted to call for payment on November 2 at par the $20,000,000 three-year 5 per cent notes due on May 5, 1935, with the proceeds of a new issue of similar amount but bearing a lower interest rate, which is expected to run for three years. After the notes have been retired the company will have no note maturities prior to the $16,000,000 due on April 15, 1936.

The company just reduced its annual dividend from $10 to $8 a share. This action had been expected ever since the Massachusetts Department of Public Utilities, in a rate reduction order two months ago, stated that it was "probable that both dividends and proper provisions for depreciation cannot be maintained unless the company's business materially improves."

Current Earnings Reports

Operating Companies

	1934	1933
Alabama Power (Year to Aug. 31)		
Gross earnings	$15,485,682	$15,427,982
Net balance	522,663	888,541
Consolidated G., Elec. Lt. & Pwr. Baltimore (8 mos. ended Aug. 31)		
Gross earnings	19,147,888	18,082,229
Net balance	3,117,601	3,014,286
Georgia Power (Year to Aug. 31)		
Gross earnings	22,204,725	22,040,542
Net balance	1,150,359	2,487,037
Kansas City Pwr. & Lt. (Year ended Aug. 31)		
Gross earnings	14,584,640	14,336,240
Net balance	3,309,336*	3,433,338*
New Orleans Pub. Serv. (Year ended Aug. 31)		
Gross earnings	14,963,142	14,955,022
Net balance	314,522†	298,259
Pennsylvania Pwr. & Lt. (Year ended Aug. 31)		
Gross earnings	33,887,417	32,738,951
Net balance	5,391,516	5,865,470
Tennessee Elec. Pwr. (Year to Aug. 31)		
Gross earnings	12,268,093	11,298,080
Net balance	442,813	605,578

Holding Companies

	1934	1933
American P. & L. and subs. (Year ended July 31)		
Gross earnings	$74,407,124	$73,211,242
Net balance	3,188,094	6,184,438
Amer. Water Works & Elec. and subs. (Year ended Aug. 31)		
Gross earnings	45,249,182	42,043,808
Net balance	2,029,428	2,265,132
Electric P. & L. and subs. (Year ended July 31)		
Gross earnings	71,597,774	69,343,419
Net balance	775,194†	272,630
National P. & L. and subs. (Year ended July 31)		
Gross earnings	70,818,448	68,487,873
Net balance	6,811,606	7,414,974
Commonwealth & Southern and subs. (Year ended Aug. 31)		
Gross earnings	113,566,452	109,036,489
Net balance	744,142†	178,599

*Available for all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net balance—Balance available from income for common stock dividends.

Protecting Lines From Sleet

On an Eastern power system where sleet-thawing schedules are in use on certain lines but not on others, the protection of the latter is partially achieved in the following manner:

During severe sleet storms it is customary to plan line loadings in the areas affected so as to obtain maximum current on the transmission circuits, the heating effects of which will in some degree thaw the sleet deposited or reduce accumulation of sleet in part. While it is not contended by the operating engineers that the success of such a procedure is all that can be desired, it nevertheless is regarded as a step in the right direction and accomplishes no little good in cases where the conditions and layout have not as yet been met by and adapted to a thawing schedule.

The problem of increasing line currents in the areas concerned is approached from a kilowatt load basis in some cases, or, in periods of light load, reactive-kva. transmission is resorted to. A combination of kilowatt load and reactive-kva. transmission may be advisable from time to time. Use of synchronous condensers on one end of the transmission system, operating under-excited, and with generating capacity operating on the opposite end of the system running over-excited, establishes the reactive-kva. transmission in the section desired. Such a procedure is of course executed within the voltage range of all stations involved.

On this system regular sleet thawing is resorted to only where double circuits exist between stations, allowing the regular load to be carried on one circuit while the other is being thawed, and vice versa. An automatic schedule is set up so that the thaw can be carried on regardless of telephonic communication. In this practice a line current of 300 amp. is usually standardized for thawing and continued for 45 minutes per line.

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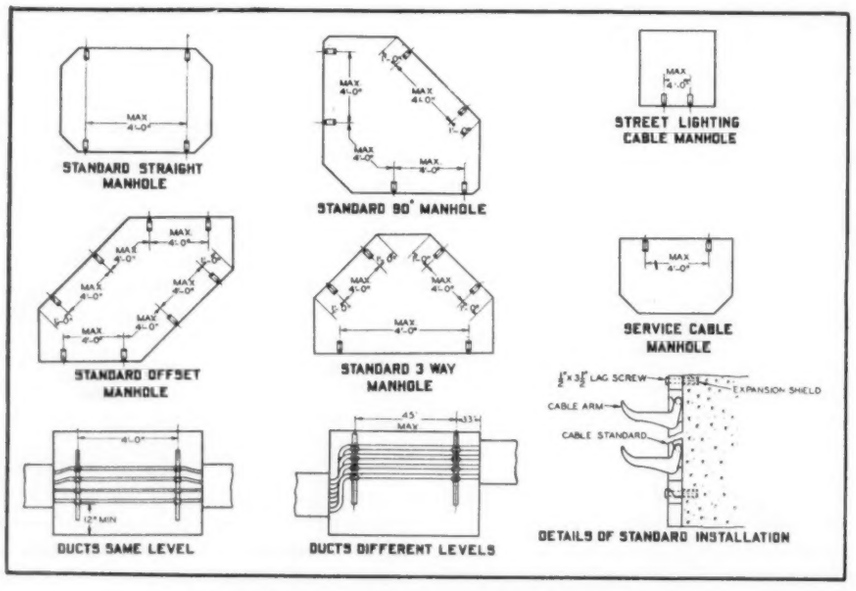
Manhole Standards

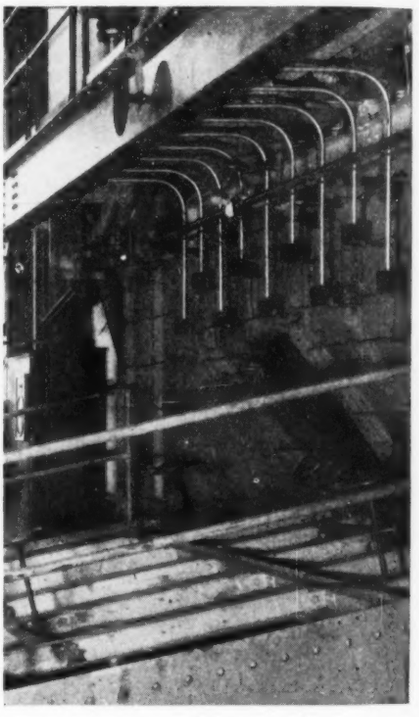
It is more desirable to attach cable standards to manhole walls by means of expansion bolts than to attempt to set these bolts in the masonry while it is being built. The accompanying illustration shows some arrangements used by Detroit Edison Company.



Detroit has standard manholes for cables

Pilot Lamps Aid Furnace Operation

To facilitate checking the operation of pulverized coal burners at the Buzzard Point station of the Potomac Electric & Power Company, Washington, D. C., the Stone & Webster Engineering Corporation provided individual pilot lamps for each furnace to indicate automatically when burners are in or out of service. There are two motor-driven pulverizers and six burners per furnace in the initial installation, and later a third pulverizer and three more burners will be added per furnace. Closing of the circuit breaker in the motor supply for any pulverizer switches three lamps into circuit by means of an auxiliary contact, these lamps corresponding to the three burners which are always operated in connection with that particular pulverizer. Lamps are 18-volt carbon bulbs with red lenses in se-



Pilot lamp mountings for nine pulverized coal burners to complete furnace equipment

ries with resistance on the 115-volt direct-current auxiliary station service supply and are mounted in steel boxes made up on the job and attached to the lower ends of ¾-in. iron conduit carrying the individual feeds.

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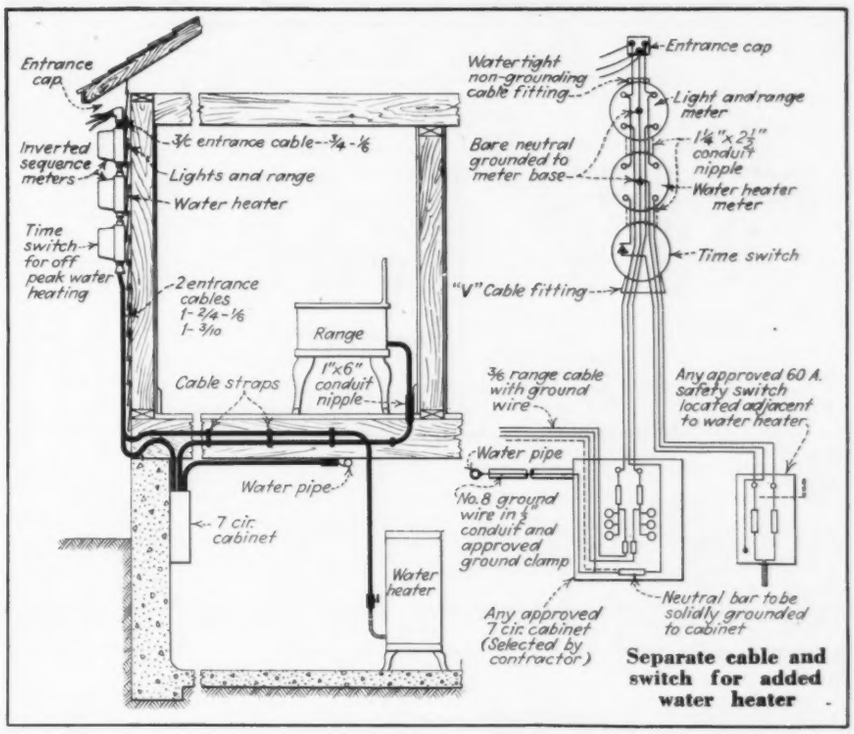
Entrance Cable With Time Switch Costs

In some instances where water heating is added to existing light and range facilities it proves advantageous to install a separate cable and switch from the outdoor inverted sequence meters. S. B. Clark of the Northwestern Electric Company told a Portland meeting of the engineering division of the Northwest Electric Light and Power Association that the cost for this type of adequate installation was $27.02 using service entrance cable and $41.66 using rigid conduit wiring.


Entrance cap
Inverted sequence meters
Time switch for off peak water heating
3/c entrance cable-¾-⅛
Lights and range
Water heater
2 entrance cables 1-2/4-⅛ 1-3/10
Range
1"x6" conduit nipple
Cable straps
Water pipe
7 cir. cabinet
Water heater
Water tight non-grounding cable fitting
Entrance cap
Light and range meter
Bare neutral grounded to meter base
1¼"x2½" conduit nipple
Water heater meter
Time switch
"V" Cable fitting
⅜ range cable with ground wire
Any approved 60 A. safety switch located adjacent to water heater
Water pipe
No. 8 ground wire in ½ conduit and approved ground clamp
Neutral bar to be solidly grounded to cabinet
Any approved 7 cir. cabinet (Selected by contractor)

Separate cable and switch for added water heater

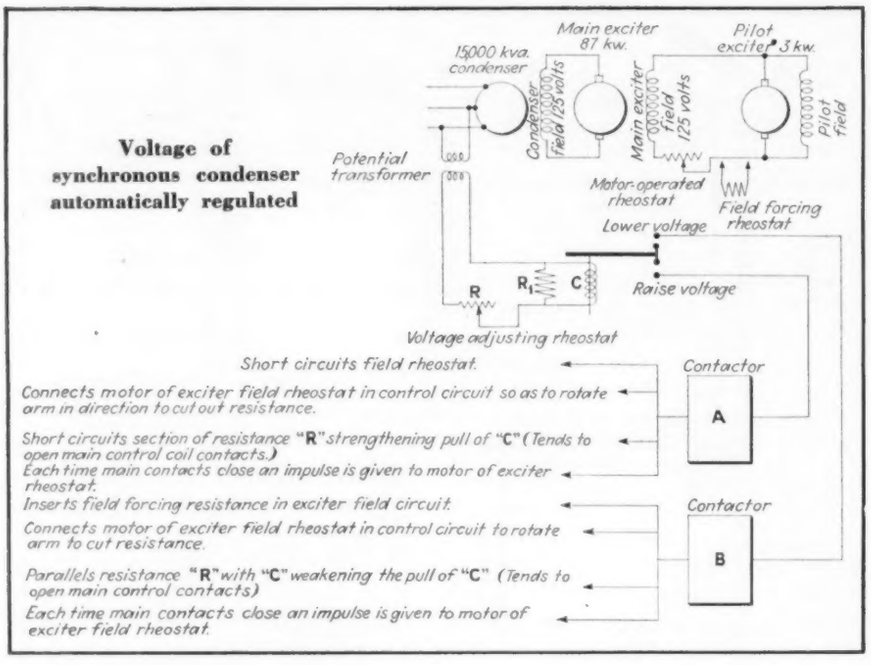
Detailed Cost of Adequate Service Installation for Range, Lights and Off-Peak Water Heater for New Residence

A—Using Rigid Conduit

Item	Number Required	Unit Cost	Extended Cost	
Service				
½-in. Conduit, ft	15	$0.1829	$2.7435	
½-in. Locknuts	2	0.0330	0.0660	
½-in. Bushings	1	0.0545	0.0545	
½-in. Lb. condulet	2	1.0290	2.0580	
½-in. T condulet	1	1.0290	1.0290	
½-in. Condulet blank covers	3	0.3139	0.9408	
½-in. Entrance condulet and cover	1	0.5860	0.5860	
½-in. Pipe straps	5	0.0135	0.0675	
½-in. Short conduit nipple	1	0.1200	0.1200	
No. 4 R.C. stranded wire, ft	55	0.03815	2.0983	
100A. 7-cir. cabinet (to be selected by contractor)	1	(Price dependent on selection)		
Misc.—tape, solder, etc.	Job	.....	0.5000	
Material				$10.26
Labor				11.00
Range				
1-in. Conduit, ft	15	0.1352	2.0280	
1-in. Conduit locknuts	4	0.0215	0.0860	
1-in. Conduit bushings	2	0.0415	0.0830	
No. 6 R.C. stranded wire, ft	50	0.02985	1.4925	
Outlet box, 4 11/16x4 11/16x2½-in.	1	0.5360	0.5360	
4 11/16-in. box cover, plain	1	0.2160	0.2160	
Federal bushings	1	0.0600	0.0600	
1-in. Pipe straps	5	0.0103	0.0515	
Misc.—tape, solder, etc.	Job	0.5000	0.75	
Material				$5.30
Labor				3.00
Water Heater				
¾-in. Conduit, ft	35	0.0941	3.2935	
¾-in. Conduit locknuts	4	0.0130	0.0520	
¾-in. Conduit bushings	2	0.0225	0.0450	
¾-in. Lb. condulet and cover	1	0.5488	0.5488	
No. 8 R.C. stranded wire, ft	75	0.01482	1.1100	
30A. 2-p. 250-volt safety switch	1	(Price dependent on selection)		
¾-in. Flexsteel tubing, ft	5	0.09	0.4500	
¾-in. Box connectors	2	0.1500	0.3000	
Material				$5.80
Labor				3.50
Grounding				
½-in. Conduit, ft	10	0.07370	0.7370	
½-in. Conduit locknuts	2	0.00665	0.0133	
½-in. Conduit bushings	1	0.01015	0.0102	
½-in. Groundlet	1	0.60000	0.6000	
Ground jumper—12-in.	1	0.26200	0.2620	
No. 8 R.C. wire	12	0.01482	0.1778	
Material				$1.80
Labor				1.00
Total material				$23.16
Total labor				18.50
Grand Total				**$41.66**

B—Using Service Entrance Cable

Item	Number Required	Unit Cost	Extended Cost	
Service				
Entrance cap. No. 5536	1	$0.4000	$0.4000	
3/c—Entrance cable (2/4-1/6), ft.	19	0.1700	3.2300	
Box connectors No. 3206	1	0.2192	0.2192	
"V" cable fitting	1	0.5000	0.5000	
Squeeze connectors for 3/c No. 4	1	0.1500	0.1500	
100A. 7-cir. cabinet (to be selected by contractor)	1	(Price dependent on selection		
Cable straps	10	0.0272	0.2700	
1¼x2½-in. Pipe nipples	2	0.1200	0.2400	
Material				$5.00
Labor				6.00
Range				
3/c—No. 6 range cable (with ground wire), ft	17	0.1440	2.4480	
1-in. Conduit	1	0.1352	0.1352	
1-in. Conduit bushings	2	0.0415	0.0830	
Cable straps	10	0.0272	0.2720	
1-in. Box connectors	1	0.1500	0.1500	
Misc.—tape, solder, etc.	Job	.....	0.2500	
Material				$3.34
Labor				2.00
Water Heater				
3/c—No. 10 entrance cable, ft.	37	0.0880	3.2560	
Squeeze connectors for 3/c No. 10	2	0.1000	0.2000	
Cable straps for 3/c, ft	15	0.0160	0.2400	
2/c No. 10 Bx., ft	4	0.1200	0.4800	
Box connectors for 2/c 10 Bx.	2	0.1000	0.2000	
30A. 2-p. 250-volt safety Sw. (to be selected by contractor)	1	(Price dependent on selection)		
Material				$4.38
Labor				3.50
Grounding				
½-in. Conduit, ft	10	0.07370	0.7370	
½-in. Conduit locknuts	2	0.00665	0.0133	
½-in. Conduit bushings	1	0.01015	0.0102	
½-in. Groundlet	1	0.6000	0.6000	
No. 8 R.C. wire, ft	12	0.01482	0.1778	
Material				$1.80
Labor				1.00
Total material				$14.52
Total labor				12.50
Grand Total				**$27.02**


Voltage of synchronous condenser automatically regulated
15000 kva. condenser
Main exciter 87 kw.
Pilot exciter 3 kw.
Condenser Field 125 volts
Main exciter Field 125 volts
Pilot Field
Potential transformer
Motor-operated rheostat
Field forcing rheostat
Lower voltage
Raise voltage
R
R1
C
Voltage adjusting rheostat
Short circuits field rheostat.
Contactor
Connects motor of exciter field rheostat in control circuit so as to rotate arm in direction to cut out resistance.
A
Short circuits section of resistance "R" strengthening pull of "C" (Tends to open main control coil contacts.)
Each time main contacts close an impulse is given to motor of exciter rheostat.
Inserts field forcing resistance in exciter field circuit.
Contactor
Connects motor of exciter field rheostat in control circuit to rotate arm to cut resistance.
B
Parallels resistance "R" with "C" weakening the pull of "C" (Tends to open main control contacts)
Each time main contacts close an impulse is given to motor of exciter field rheostat.

Condenser Control Hand or Automatic

Automatic excitation with facilities for changing readily from and to hand control provides convenient operation of a 15,000-kva. synchronous condenser installation to correct power factor at the receiving end of an important Eastern transmission line. Two direct-connected exciters are employed. A 3-kw., 125-volt, self-excited pilot generator furnishes current for the shunt field of an 87-kw., 125-volt main exciter whose armature is connected directly to the main condenser field. The current in the last is varied by a motor-operated rheostat in the exciter field. The pilot exciter is operated at a constant voltage. A connection not shown is made from the pilot exciter to the motor-driven rheostat so that it is possible through reversing contactors to rotate the rheostat arm to cut resistance in or out of the main exciter field circuit.

A constant voltage is held on the main exciter by short circuiting the exciter field rheostat or inserting resistance in the field in addition to moving the arm of the motor-operated rheostat. The regulator parts in this installation are at rest except at times when the condenser voltage is not at the proper value. The following is a summary of the regulator action:

A potential transformer in the condenser leads is connected to a main control coil *C* through a resistance *R*. The operation of *C* closes the reversing contactors *A* or *B*, depending on whether the voltage is low or high. If the voltage is low contactor *A* is energized and the following actions occur:

1. Exciter field rheostat is short circuited, resulting in the exciter voltage building up rapidly as in the use of the vibrating type regulators employed with generators.
2. The motor of the power-driven field rheostat is connected in the control circuit so as to turn the rheostat arm in a direction to cut out resistance.
3. A section of resistance *R* (in series with the main control coil) is short circuited, thus strengthening the pull of the control coil *C*. This opens the main contacts. Meanwhile the motor-operated rheostat has cut out resistance, strengthening the condenser field and increasing the voltage. If voltage is still low main contacts re-engage and above procedure is repeated.

Each time that the main contacts of the coil *C* engage an impulse is given to field rheostat motor. When the correct voltage is reached the main contacts of *C* remain open and contactor *A* is de-energized. Upon a decrease of line voltage the above operations occur very rapidly and contactor *A* appears to vibrate simultaneously with the rheostat arm.

When load conditions are such that the condenser voltage exceeds normal the pull on *C* is increased and contactor *B* energized by the following operations:

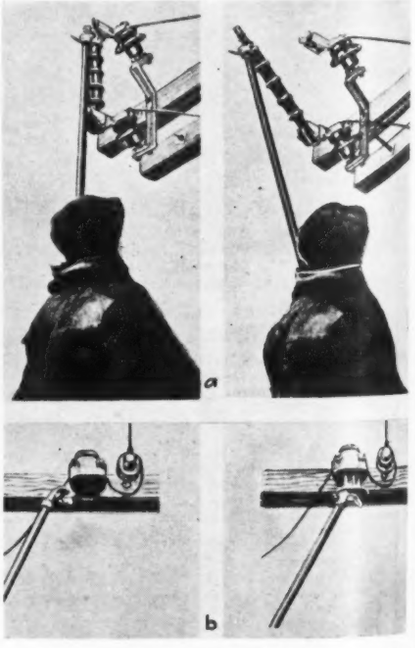
1. An additional or "field-forcing resistance" is placed in series with main exciter field circuit, decreasing exciter voltage.
2. The motor-operated field rheostat cuts in resistance.
3. A resistance R_1 is connected in parallel with the control coil *C*, weakening its pull. This opens the main contacts. The arm of the main exciter field rheostat has been turned to increase the exciter field resistance, and if the proper amount of resistance has been added to reduce the condenser voltage to normal the main contact will remain open, de-energizing contactor *B*. If the condenser voltage is still high the main contacts re-engage and operations are repeated until normal voltage is reached.

To change from hand control to automatic, or vice versa, two rotary type switches, not shown, are provided. One operates the exciter field rheostat, and when placing the regulator in service this switch is adjusted until the condenser voltage is normal. The other switch can then be thrown from hand control to automatic, placing the regulator in service. When the automatic regulator is in use the first switch is disconnected to afford protection against error in operating it. In changing from automatic to hand control all that is necessary is to turn one switch. This is done when the regulator is not operating to correct voltage. By means of the voltage-adjusting rheostat the value of regulated voltage can be changed without varying the spring tension on the arm of the regulating element.

•

Safe Operation of Primary Cutouts

No matter how long the operating stick, there is always a certain amount of danger in operating live parts. Flashes, too, may be injurious to the eyes. Experienced operating managers therefore generally issue strict instructions that each man must wear rubber gloves and goggles when operating primary cutouts. The accompanying illustration shows the typical instructions as used by the West Penn Power Company.



Safety instructions should be obeyed

(a) Keep clear of fuse tubes until all cutouts are open. Each man who operates primary cutouts must wear goggles and rubber gloves and use clamp stick. (b) Twist stick to close jaws of puller head firmly on the porcelain knob.

MICABOND

A bonded mica material of exceptional quality. Unsurpassed in electrical and heat resisting properties.

BECAUSE IT IS UNIFORM

MICABOND is made with hand-split Indian and Canadian mica splittings of the finest quality obtainable. The best grade of shellac is used for bonding purposes.

Every operation during manufacture is carefully controlled and daily tests on the finished products are performed so as to ensure the maintenance of the high quality that is our standard.

MICABOND forms include Molding Plate, Segment Plate, Heater Plate, Flexible Sheets, Tape, Tubing; Punched and Formed Parts such as "V" Rings, Washers, Segments and Bushings; and mica in combination with paper, cellophane, fish paper, silk, etc.

All MICABOND parts are fabricated at our Valparaiso, Ind., plant, where no effort is spared to meet customers' requirements on rush or emergency orders. Our engineers are often able to suggest changes in design which result in lower costs or more efficient insulation.

COMPLETE INSULATION SERVICE

MICABOND is but one of the uniformly high quality insulating materials made by Continental-Diamond. Continental-Diamond offers a material for your every insulating need including Vulcanized Fibre, Phenol Fibre (Dilecto), Celoron, Fish Paper, and Vulcoid.

THE MICABOND CATALOG GIVES COMPLETE DATA ON THE PROPERTIES OF THE MANY GRADES OF MICABOND AND FULL INFORMATION ON MACHINING MICABOND. WRITE US IF YOU WOULD LIKE A COPY.

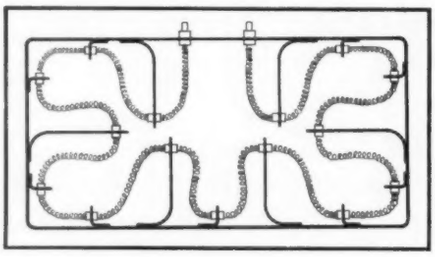
Chicago—Cleveland—New York—Los Angeles—Spartanburg, S. C.—Bridgeport, Pa.

CONTINENTAL-DIAMOND FIBRE COMPANY

NEWARK DELAWARE

Better Heat Control in Calibrating Bath

Maintenance of heat at 212 deg. F. ±0.2 deg. is the requirement for oil baths used in a Middle Western manufacturing plant for calibration and final inspection of temperature indicating instruments. Commercially available electric immersion heaters



Open element heaters best for calibration oil bath

were first tried, but were not satisfactory because their mass prevented the necessary close heat regulation and also the consequent rapidly recurring "on" and "off" conditions materially shortened their life. The need was apparent for a type of heater quickly responsive to regulation, low in cost and easy to maintain.

The calibration tank is 5 ft. long, 1 ft. wide and 1 ft. deep, filled with oil to within about 1 in. from the top. The oil is circulated in the tank by means of motor-driven impeller pumps at each end. Lengthwise in the middle of the tank is a narrow basket of coarse mesh steel screen inclosing the heating units and between the basket and the wall of the tank on each side are immersed the bulbs of the heat indicators under test. The problem is to maintain an exact temperature along the whole length of the bath, compensating for the constant removal of calibrated indicators and the entrance of cold ones fresh from the production line.

As stated, the ordinary immersion type heater was not found equal to the duty and something better suited to the requirement had to be devised. This was done by making up a rectangular heater frame of $\frac{3}{8}$-in. flat steel stock with flat strips welded inside it to support the heating wire. The Nichrome resistance wire was coiled on a $\frac{1}{8}$-in. arbor, pulled out to proper separation between turns and threaded through circular porcelain insulators fixed at the ends of the flat strips as is shown in the sketch. Three such heaters are used in each tank, the one in the center being in continuous operation and the two end ones used for regulation. Some of the heaters were made up for 500 watts capacity and others for 700, cut and try for best performance. As a matter of fact, both sizes were found to work equally well.

Heat control is accomplished by means of a standard American Scientific Corporation mercury column and relay at one end of the tank, cutting the end heaters on and off as is required. After a heater has been in service for a time it becomes pretty well carbonized from the oil. This carbon is quickly burned off by taking the heater from the tank and operating it for a few minutes in the air.

•

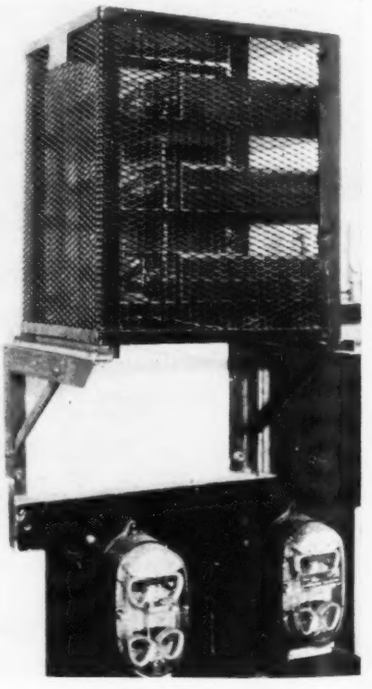
Capacitor Also Pays in the Small Plant

By L. C. SHELAIN

Power Engineer Central Illinois Electric & Gas Company, Rockford, Ill.

One never hears very much about the benefits of power-factor correction in small industrial plants. Usually, capacitor installations talked or written about are in plants of several hundred horsepower connected load. Power salesmen who have power factor clauses in their rates can build up a lot of good will for their companies by analyzing their customers' conditions as to the possible savings by correction of power factor. When the savings effected by correction of power factor show a greater return on the investment than the customer could make by putting the same money back into his business, it would be poor policy not to accept the power engineer's recommendation.

Keig-Stevens Baking Company of Rockford, Ill., has a load that peaks at from 34 to 48 kw., depending on the time of the year and other factors. The power factor before correction varied from 73 to 79 per cent. The average monthly power bill was $225. The rate allowed a 5 per cent discount for 80 per cent power factor and a 10 per cent discount for 90 per cent power factor. After carefully considering the load characteristics of the plant, it was decided that 15 kva. in capacitors would earn the 10 per cent discount and raise the power factor to 99 per cent, which would allow for some additional motors in the future. Therefore, three standard 5-kva. capacitors were installed, one on each phase, the service being 220 volt, 60 cycle, three phase.



Capacitor on brackets

Symbolic in that the capacitor improves the power factor of the load measured by the meter

Total cost of the capacitors delivered to the baking company installed ready for operation was $365. The installation was made in February of 1933. Losses due to the capacitor cost $10.80 per year. The discounts earned paid for the entire installation

Engineering Progress Cannot be Stopped

Industry may lag and finance totter, but engineering goes forward.

Through boom or depression, engineering skill and determination improves electric light and power service, creates new energy demand and reduces generating costs.

We are proud to be able to claim justifiably, that Combustion Engineering accomplishments in the service of Central Stations have substantially contributed to this result.

Higher steam pressures and temperatures, greater overall efficiencies, larger boiler units and extremely high availability characterize the design and performance of outstanding boiler and firing installations built by C-E for electric light and power companies during 1929 and the post-boom years.

Present loads and conditions in the field indicate that large expansion and further improvement in fuel economy in light and power generation will be needed. In the working out of these objectives Combustion Engineering and the Central Station industry will go forward together toward new achievement both in completely new stations and in superimposing higher pressure steam generating units on existing lower pressure equipment.

C-E engineers are at the service of your engineers and their consultants for the development of steam generating equipment that will produce still greater economy—more favorable heat cycles, lower B.t.u. rates—characteristics that will meet new conditions as they arise in the years ahead.

COMBUSTION ENGINEERING COMPANY · INC.

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Canadian Associates, Combustion Engineering Corporation, Ltd., Montreal A-175

BOILERS—STOKERS—PULVERIZED FUEL SYSTEMS—FURNACES—AIR HEATERS—ECONOMIZERS

Complete steam generating units of standard overall design or comprised of any combination of boiler and firing equipment

ENGINEERING

in sixteen months. This shows a return of 75 per cent on the investment. The capacitor is mounted on the wall with brackets at a height that requires no floor space. Needless to say, the customer is very well pleased with the installation. He appreciates the service rendered him as it cut his power cost and proved to him that the power company wanted him to earn the lowest possible rate per kilowatt-hour for his service.

•

Electric Heat for Sprinkler Valves

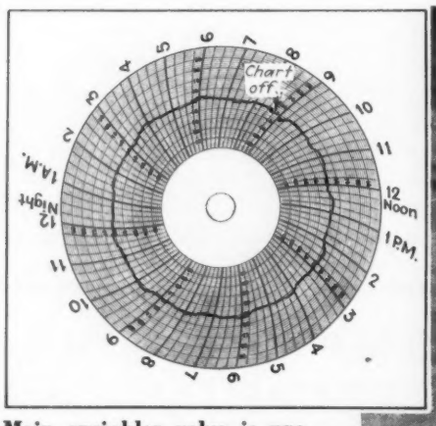
In a Brighton, Mass., warehouse of the John Wood Manufacturing Company the use of electric heat, thermostatically controlled, to maintain a temperature of between 43 and 45 deg. F. in a sprinkler valve room and at adjoining auxiliary valve locations worked out most satisfactorily during the winter season of 1933-34.

Except for the electric heat concentrated within wooden inclosures about the valves and piping, the warehouse is unheated and has its doors frequently opened during the course of the day as shipments are moved in or out. The main sprinkler valve—on a vertical riser—is housed in a small room with two 500-watt strip heaters mounted about a foot from the floor on adjacent walls. Similarly, two 150-watt strip heaters warm the auxiliary valve housings located to right and left of the main valve room, while two additional 150-watt units are spaced equally inside the housing which incloses the horizontal water lines connecting main and auxiliary valves. The thermostat itself is located in the main sprinkler valve inclosure, slightly below the level of the 500-watt heaters which flank it.

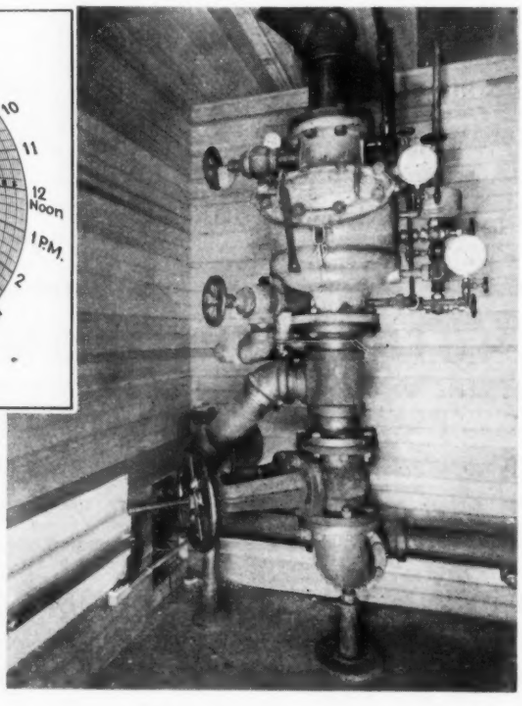
As shown in the following table, the lowest mean temperature was reached during February and corresponded with the maximum current consumption of 696 kw.-hr.; strikingly indicative of the close control possible with electric heat are the figures for power consumption for the months of December and January, where the difference of only 40 kw.-hr. matches a corresponding difference in monthly mean temperature of just 2.8 deg. F.:

Months	Monthly Mean Temperatures (Deg. F.)	Power Consumption (Kilowatt-Hours)
October	52.7	2 *
November	38.3	152
December	26.8	460
January	29.6	420
February	17.5	696
March	35.1	220

*Twelve days, October 20 to November 2.



Main sprinkler valve is protected with two 500-watt heaters with thermostat located immediately adjacent

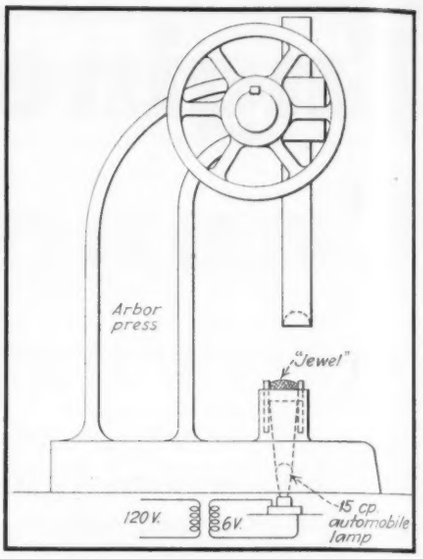


With outside temperature varying between 24 and 37 deg., main valve room was held at a constant level of 50 deg. throughout the 24 hours of December 5, 1933

•

Light Exactly Where It's Needed

Illumination of translucent letters behind glass "jewels" is a commonly used indicating means on instrument boards of various kinds. The usual assembly is a short metal tube containing a small electric lamp, the tube closed at the front by the "jewel," on the back of which is laid or pasted the indicating letter. In the production assembly of such units in a Middle Western plant the functions of assembly and inspection are combined into a single operation by a very simple electric lighting arrangement.



Assembly and inspection combined in illuminated arbor press.

The jewels are set in the holding rings in a small hand-operated arbor press. The operator drops the ring into the die, lays in the circle of paper on which the letter is printed, places the jewel on top and then brings down the crimping arbor. Before the press was fitted with its special little electric light there had to be a following inspection, another production operation, to be sure that the letter was centered properly, the paper not torn, the jewel not cracked and, in general, that the product was perfect. But now the operator inspects the work before it is removed from the press.

The sketch shows how the trick was done. A hole large enough to accommodate a 15-cp. automobile lamp was bored in the bed of the press. The die was made open instead of closed at the bottom. Current from the lamp comes from a 110/6-volt transformer on the underside of the bench top. The light from the lamp shines up through the die and illuminates the work while it is being assembled. Then when the arbor has been brought down and the operation completed, the jewel is right under the operator's eyes, just as it will look on the instrument board. And if it does not look right to the operator it never gets on the board.

month a co-operative advertising campaign in support of the educational and collective sales activities of 54 Power Transmission Clubs with more than 2500 members.

The central theme of our advertising is *cost-reduction* in the field of power and power application through correction or modernization. Any realistic presentation of this theme must inevitably discuss the correct use and application of motor power as well as motor horsepower investment. Our advertising will be factual based on case studies and proved engineering data. It will, and is intended to, raise questions regarding power costs. Constructive, studied answers to such questions are a joint obligation and responsibility of the Electrical and Power Transmission Industries.

* * *

Power Transmission Clubs have been organized in key industrial cities to render constructive service to customers. Their number is growing. Members are qualified to render constructive service as a result of study of supplied case information as well as local plant problems.

POWER TRANSMISSION COUNCIL

(Sponsored by Mechanical Power Engineering Associates)

An association of producers and distributors of power, power units and mechanical equipment for the transmission of power.

370 LEXINGTON AVENUE, NEW YORK

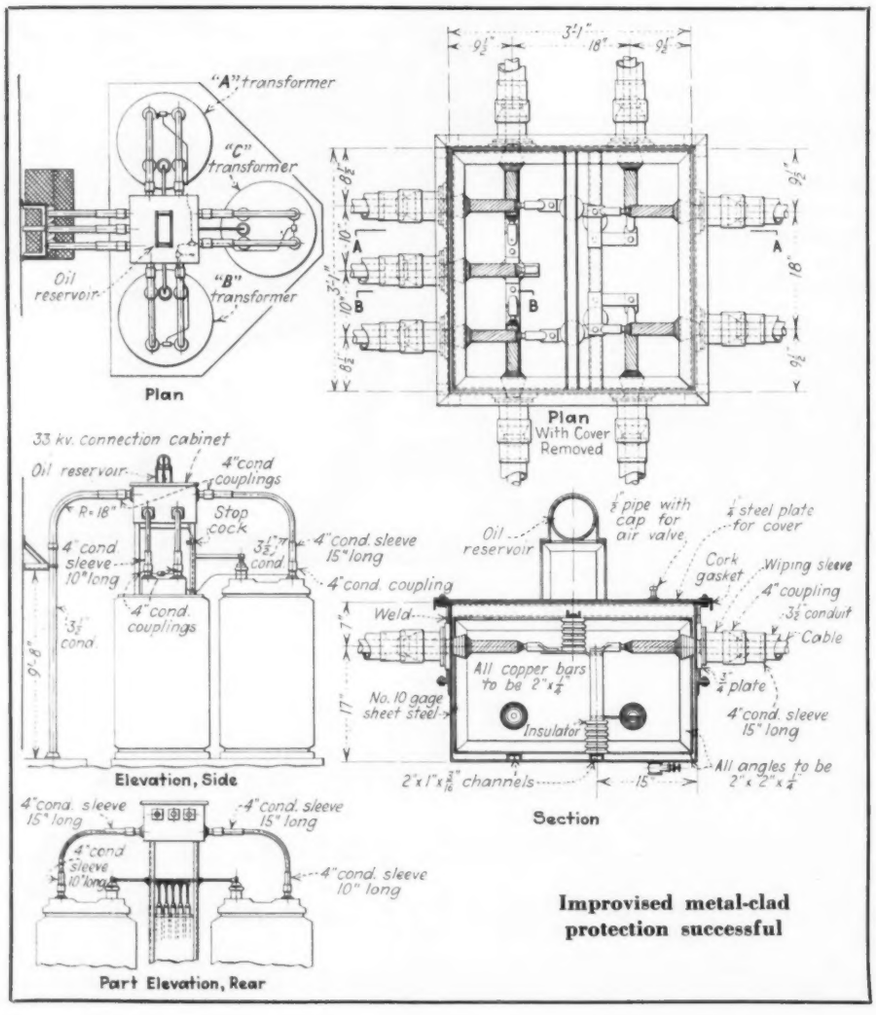
THE BEST WAY TO GET THE POWER TO THE WORK: THIS IS THE JOINT RESPONSIBILITY OF THE INDUSTRIES ENGAGED IN THE PRODUCTION AND APPLICATION OF POWER TO MANUFACTURING.

Ordinary Materials for Metal-Clad Job

By RICHARD BANZ
Chicago, Ill.

Much can be done in the way of metal-clad construction, without going to especially designed structures of that type, simply by making use of commonly available materials arranged together with a little ingenuity. A good example of this is afforded by the accompanying drawings, which show a metal-inclosed installation of transformers supplying energy to a rotary converter on the system of a Middle Western utility.

The three transformers are arranged in a triangle with their secondary sides inward. The area thus inclosed by the transformers is an excellently well-protected space for carrying down the numerous secondary leads peculiar to this kind of installation. Above the transformers and at the center of the triangle formed by them is a steel box, shown in detail in the drawings. From the front and the two sides of the box emerge the pairs of primary leads to each transformer. At the back of the box enter the three conductors of the primary supply. All of these leads are standard lead-covered cable and are inclosed in metal conduit suitably bushed and connected to the box and to the transformer cases. Inside the box are three short lengths of copper bar mounted on insulated bus supports and to which the supply conductors and the transformer leads are connected to make the primary delta. The box has a gasketed cover, bolted down to be airtight, and on the cover is mounted a small oil tank which keeps the oil with which the box is filled under constant pressure.



Improvised metal-clad protection successful

•

Piped Lighting for Night Tennis

By R. T. CORFIELD
Assistant Electrical Engineer
Utah Copper Company, Garfield.

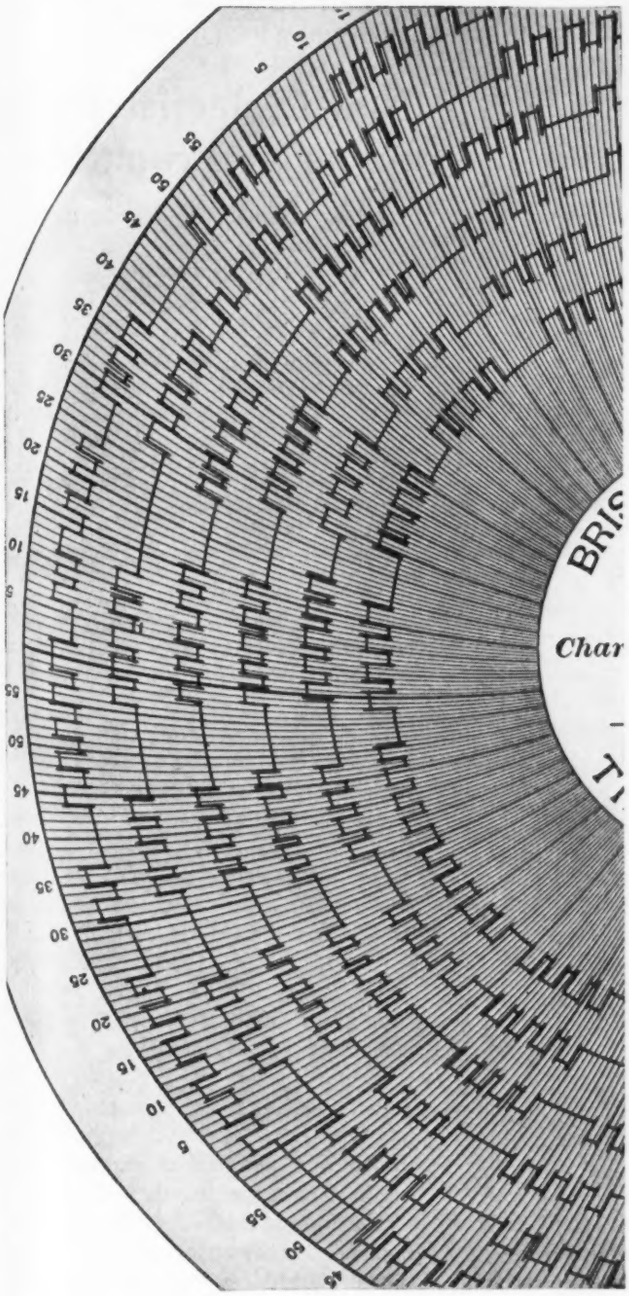
Tennis ball velocities are so high that good lighting—intensity and distribution—are required for night playing. Two tall poles at the ends with a single row of high-wattage lamps spaced 30 to 40 ft. failed to give the desired intensity and uniformity. The system shown in the illustration on page 82 was designed to overcome these limitations. A comparison of ranges of intensities as shown in the following table fully justifies the new system:

	Foot-Candles	
	New System	Conventional System
Average on service court...	4.5	1.96
Average on back court	3.5	1.56
Average on base line	3.5	1.34
Average on side lines	4.0	1.18
Average on net.....	4.25	1.8
Average of 152 readings was	4.15	

In this system a ½-in. conduit line is suspended from a ⅜-in. steel strand by $\frac{1}{16}$x1-in. galvanized iron hangers; standard 18-in. R.L.M. reflectors are supported from condulets by a ½x1-in. close nipple. A uniform mounting height of 19 ft. is maintained. The supporting pipes were made from 4- and 5-in. scrap pipe, set in concrete and truss guyed with ⅜-in. steel strand. A 4-ft. length of BX conduit is used to carry the wiring into the main supporting standards in order to provide the necessary flexibility for the catenary.

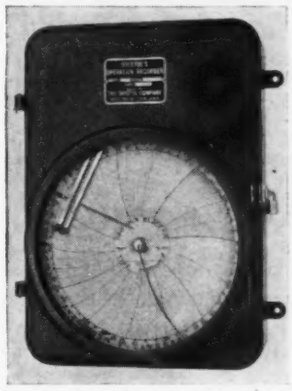
Installed, the cost of the new system is approximately 25 per cent greater than the conventional system, but the following advantages are evident: Uniform illumination; necessary intensity at all points on the

Assist in controlling production and developing best methods



BRISTOL'S *Operation Recorders furnish continuous chart records of (1) fact of operation (2) time of operation (3) and duration for hundreds of different operations including:*

Alternating Current Feeder Regulator	Gas Holders	Rotary Kilns
Belt Conveyors	Hydraulic Grinders	Sintering Machines
Centrifugal Wringers	Hydrometers	Switches
Circuit Breakers	Motor Running Time	Telephone Toll Line Cables
Conveyors	Open Hearth Furnaces	Trolley Cars
Crushing Machines	Paper Machines	Turbine Sluice Gates
Dredges	Plunger Feeder	Valves
Dumpers	Pulp Grinders	Water Level
Elevators	Pulp Mill Beaters	Water Wheel Gates
Engine Governors	Pumps	Weighing Machines
	Railroad Cars	



BY PROVIDING a continuous chart record of the occurrence of an operation or motion, the time of day it took place and how long it continued, Bristol's Operation and Motion Recorders enable management to set up the best method, to standardize production, and promote economy.

BRISTOL'S Electrical Operation Recorder, Model 94OM, incorporates an electro-magnet which is energized by current, supplied from batteries or lighting circuit, whenever the electrical circuit is closed. The operation may occur at one location, and the Recorder placed a considerable distance away.

BRISTOL'S Mechanical Operation Recorder, Model 94OM, is entirely mechanical. Motion or movement is transmitted from its source through a simple mechanism directly to the pen arm of the instrument and recorded on the chart. In combination with BRISTOL'S Metameter System, long distance telemetering up to 1000 miles is possible.

For interesting and helpful information, write for Catalog 1603-2.

Above: BRISTOL'S Electrical Operation Recorder, Model 940M, records on a chart the occurrence and the duration of an operation. Below: Inside assembly of a two pen Model 940M. The 12-inch Model may be fitted with as many as 12 pens. Left: A record of 6 operations on a 12-inch round chart, Model 940M

THE BRISTOL COMPANY WATERBURY CONNECTICUT

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PIONEERS IN PROCESS CONTROL SINCE 1889

Catenary and conduit for tennis court lighting

Pipe for catenary suspended conduit and concrete filled pipe for supports. No glare when serving. Plenty of light for the volleys.

court; power cost reduced one-half; no exposed wiring; reflectors may be cleaned from the ground; lamps are easily replaced.

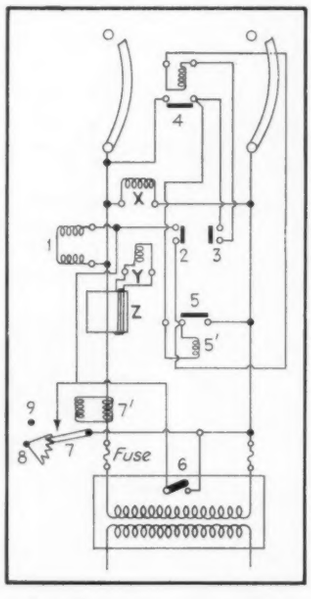
•

Network Protector Averts Pumping

High operating speed and more powerful action of the reverse energy relay which constitutes the main control device give practically instantaneous opening operation of the new network protector of the Palmer Electric & Manufacturing Company. At no potential the relay stands with contacts 2 and 3 open, but when the feeder is energized to normal potential pallet 3 closes and this closes the protector switch. At a preset value of reverse energy flow the relay closes pallet 2 and the protector locks open (lockout trip coil 1) unless the feeder breaker has also opened. The lockout trip coil is controlled by the thermally actuated pallet 5 to give delayed reclosing under predetermined reverse energy values of insufficient magnitude to trip out the feeder breaker.

If the voltages have been shifted in phase so as to reverse the phase rotation in the supply to the protector the relay and phasing coils will function to open the breaker and lock it open. The single-phase diagram shows a direct overload relay 7′ and a thermal contactor which function to provide a limited number of closing operations after the direct energy overload trips at values that would cause distress to the transformer or system.

To assure freedom from pumping due to operation of regenerative elevators, etc., the relay is purposely made insensitive to small reversals and will not respond to periodical opening impulses unless they are of large magnitude. Furthermore, a time



New network protector protects transformer against overload with inverse time reclosures for secondary shorts

delay fixes several minutes interval between reclosures for these large magnitudes. If at the end of this period the transformer is still energized the switch will reclose, but will instantly reopen if the trouble has not cleared, and will remain open for another similar period if the transformer remains alive. A lockout feature prevents reclosure if the transformer voltages have shifted in phase to such a degree as to reverse the phase rotation of the supply to the switch. If the transformer is completely de-energized after a tripout of the switch on reverse short circuit the time delay device is rendered inoperative and the switch is ready for instantaneous reclosure as soon as voltage is restored.

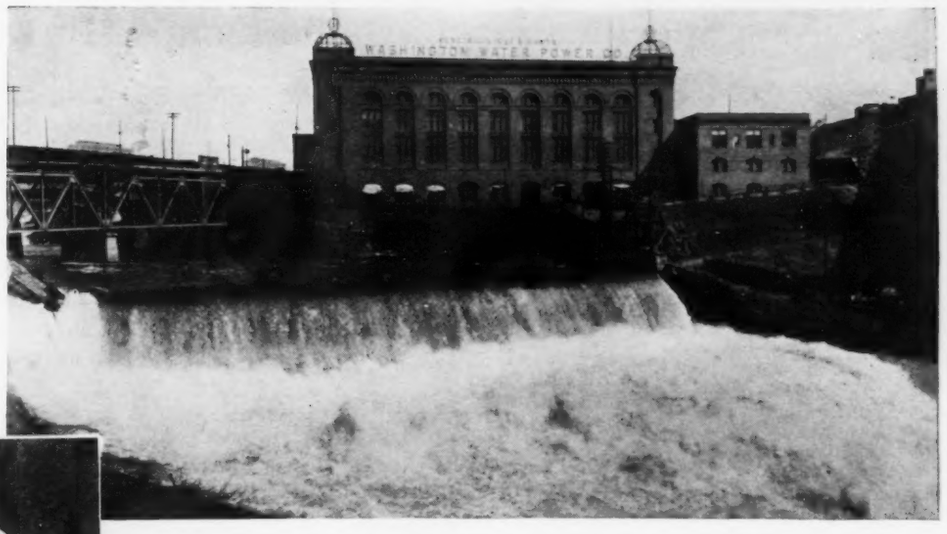
•

New Dielectric Has Superior Properties

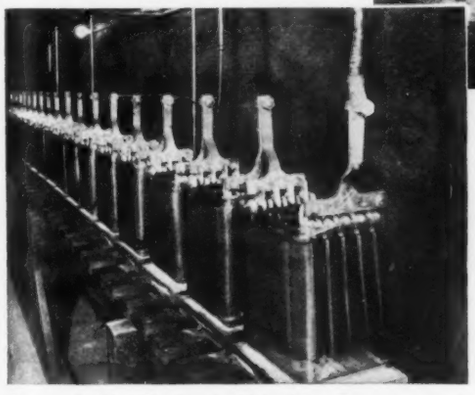
Dielectric material with properties which differ favorably from those of the prevailing compounds used as flexible insulation of wires has been produced. It is derived directly from latex, the milk of the rubber tree, and is applied to the wire in the liquid state in which it has been maintained from the time of gathering at the plantation. United States Rubber Products, Inc., has given the name "Laytex" to the substance, which was evolved in the United States Rubber Company laboratories.

This new material has a dielectric strength of 800 volts per mil and an insulation resistance constant of 54,000, which is more than twice as high as that of the highest grade of rubber required by A.S.T.M. specifications. The specific inductive capacity is 2.5 (air taken as unity), lower than the value for other flexible dielectrics. Tests show that 24-hour soaking in water does not result in absorption to such an extent that a specification value of not to exceed 4 for the specific inductive capacity cannot be obtained; for thirteen additional hours of soaking it does not rise more than 10 per cent more. Tensile strength is reported to be 5,000 lb. per square inch with elongation of 750 per cent at rupture. The set in 2-in. gage length is $\frac{1}{4}$ in.

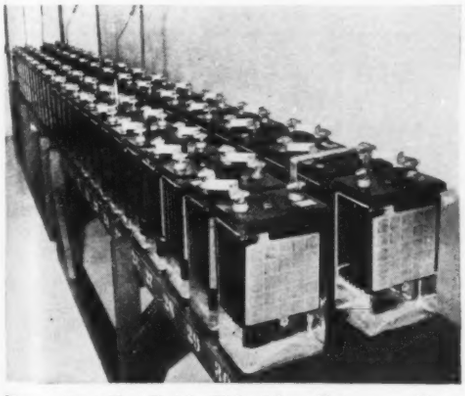
The unique method of dip application of this material affords insulation of much less thickness than now required by the codes for rubber compound. There is consequently a reduction in weight and bulk of wire and wire coils. Thorough field experience has already been acquired through application of Laytex during the development period to emergency telephone wire, non-metallic underground cables, portable cord, switchboard wire, blasting wire and vacuum cleaner and radio wire.



Post Street Sub-Station, The Washington Water Power Company, Spokane, Wash., where 60-cell Exide-Chloride Battery completed 24 years of service.



Part of 60-cell Exide-Chloride Battery as it looked just before it was removed to make way for the new Exide shown below.



New 60-cell Exide-Chloride Battery, Type EMGO, with a capacity of 160 ampere hours which replaced the 24-year-old Exide in control bus service.

After 24 Years' Service in Washington Water Power Co.

Another Exide is chosen to protect Spokane hydro-electric plant when predecessor completes long service

In November, 1909, at Spokane, the Washington Water Power Company installed a 60-cell Exide-Chloride Battery in its Post Street Sub-Station to protect and assure unfailing operation of its circuit breakers. For 24 years this battery has been kept floating across the line, ready at any hour of the day or night to furnish the protection it was designed to render.

Early this year, after a long and useful life, this faithful battery was replaced by another Exide-Chloride of 60 cells, Type EMGO, with a capacity of 160 ampere hours.

The kind of service of which Exide Batteries are capable is well known to the engineers of the Washington Water Power Company. For in its many plants, serving more than forty cities and towns of Washington and Idaho, numerous other Exides—some of 120 cells and some of smaller size—are rendering the same kind of gratifying service that has won the acclaim of engineers all over the world.

Why not let Exides take care of your battery problems? Whatever the task for which you select them, you'll not be disappointed.

Exide
BATTERIES

NRA CODE

THE ELECTRIC STORAGE BATTERY CO., Philadelphia

The world's largest manufacturers of storage batteries for every purpose

Exide Batteries of Canada, Limited ● Toronto

New Specification Portable Lamps Must Be Supported

By M. E. SKINNER
Chairman
National Better Light—
Better Sight Bureau

One phase of the activity being sponsored by the National Better Light—Better Sight Bureau impresses me as needing especial emphasis to utility executives. There is a chance that we may be victims of our own enthusiasm for the new specification lamp merchandise being sponsored by the bureau, and I believe a word of caution would be timely.

The bureau heartily indorses the effectiveness requirements of the Illuminating Engineering Society specifications for study, reading and other "working" types of portable lamps. These specifications contain minimum quality requirements, particularly with respect to the electrical circuit, which should make for long life and satisfaction to the purchaser. The bureau has been insistent that no restriction should be placed on the manufacturers which would place the specification merchandise which they were indorsing in any one price class.

What of the position of the lamp manufacturer? He has been told that if he goes to the expense of bringing out merchandise which meets the I.E.S. specifications he will merit and *should receive* the whole-hearted support of the utilities in marketing his product. Most of the portable lamp manufacturers have met this challenge splendidly. A large number have brought out models which meet the specifications and many more are modifying the design of their entire line to improve the lighting characteristics.

The utilities, and most especially those who merchandise portable lamps, must give these manufacturers support or the splendid work started will be undone.

We should appraise the value of the merchandise and then encourage prices which will give every one a fair margin of profit —manufacturer, wholesaler or retailer. People outside the utility field will only interest themselves in our program as they see opportunities for profit. In the portable lamp field we are most emphatically in their hands.

Aluminum Lines for Germany —Government Bars Copper

Copper and its alloys cannot in the future be used in Germany for overhead transmission lines, according to a ruling of the German Control Bureau for Base Metals, reported by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce in Electrical Foreign Trade Notes.

That country's ability to produce aluminum to an almost unlimited extent, while it is forced to import copper, led to early attempts to substitute the former for the latter. They were, however, premature. The material was of poor quality and this caused its use to be regarded with disfavor. Recent experience in other countries showed that this disfavor was not justified.

The total length of the high-tension power lines (at more than 3,000 volts) in Germany, England, France and Switzerland during 1933 is stated to have amounted to 76,622 km. (47,600 miles), of which 30,465 km. (18,930 miles) was of light metal alloys; of the latter, 39 per cent was steel-aluminum cables, 57 per cent pure aluminum and 4 per cent the so-called Aldrey alloy. In England alone 85 per cent of all the 9,114 km. (566 miles) of overhead lines was of light metal, especially steel-aluminum, while those at 130,000 to 200,000 volts were all of aluminum.

In France only 30 per cent of the high-tension lines at more than 30,000 volts was of light metal; this included 63 per cent of those between 85,000 and 125,000 volts and all those between 130,000 and 200,000 volts. In Switzerland the proportion of the high-tension lines was 36 per cent, and of those between 130,000 and 200,000 volts 89.5 per cent was of aluminum. In the world as a whole, of the 220,000-volt lines only 25 per cent was of copper, 75 per cent of aluminum. The higher the voltage, the greater the use of aluminum.

In Germany, on the other hand, 1,400 km. (870 miles) was of copper and only 37.3 per cent of the lines below 220,000 volts was of light metal. Those over 125,000 volts and those under 80,000 volts were of copper, contrary to practice in other countries. This relation is believed to have altered since 1933. inasmuch as the load capacity was increased and corrosion reduced by improvement of the alloys.

Northern States Power Launches Heater Drive

A recent survey in the territory of the Northern States Power Company showed that electric heater sales in 1933 were from 60 to 85 per cent below 1928 and 1929. To promote this load, therefore, the company has departed from its former policy and is conducting a 45-day campaign, selling reflector type heaters at small down payments and low monthly payments with light bills; 2,500 heaters, consuming 660 watts or more and selling for $4.95 or more will be sold through authorized dealer outlets. Dealer sales will be financed by the company. Terms will be 95 cents down and $1 per month, with no contract for a longer period of six months. The company will hold back 10 per cent on all contracts, which is to be paid the dealers on May 15 with unpaid balances deducted, the carrying charge to be added to the prices of all heaters as follows:

Carrying Charges for Dealers

Unpaid Balance	3 Mos. Charge	4 Mos. Charge	5 Mos. Charge	6 Mos. Charge
$ 1-5	$0.15	$0.30	$0.45	$0.50
6-10	0.20	0.40	0.60	0.75
11-20	0.25	0.50	0.75	1.00

Capacity at $43 per Kw.

[*Continued from page 44*]

and is of the Babcock & Wilcox Stirling type, being well adapted to the shape of the boiler room. A relatively high boiler without excessive width was required. Prices were obtained on a 500-lb. boiler to be installed, and slightly lower prices were offered with fusion welded drums, which were decided upon and specially approved by the Massachusetts Department of Public Safety. The boiler is constructed according to the A.S.M.E. boiler code as applied to welding. Each drum is fabricated from two sheets and two heads, one sheet being thick enough to furnish the required ligament between the tubes of the boiler proper, while the other is adequate for the area where tubes and openings are spaced further apart. In most cases this results in a thick sheet and a thin sheet with two heads of different dimensions. The mud drum is $2\frac{11}{16}$ in. thick with 2-in. heads. Two of the upper drums are $2\frac{3}{8}$ in. thick in the tube area and $1\frac{3}{8}$ in. thick elsewhere with $1\frac{3}{4}$-in. heads. The front drum is $2\frac{1}{32}$ in. thick in the tube section and $1\frac{5}{32}$ in. thick elsewhere with $1\frac{1}{2}$-in. heads.

The welded drum construction offers some minor advantages, such as the elimination of rivet heads and butt straps which might require cutting of the brickwork. It also eliminates leaks under butt straps and rivets. From the viewpoint of embrittlement it reduces the overstressed areas in the boiler. The only highly stressed metal is that adjacent to the tubes. This may be cold-worked, due to the expanding of the tubes into the tube sheets.

Table II

Final Cost of 7,500-Kw. Addition to Taunton Municipal Lighting Plant

	Total	Per Kw.
(a) Clearing site	$4,600.00	$0.61
(b) Building and foundations	31,400.00	4.18
(c) Steam boiler units	47,500.00	6.34
(d) Fuel-burning equipment	7,500.00	1.00
(e) Draft system	9,700.00	1.29
(f) Feed water system	12,600.00	1.68
(g) Feedwater treating plant	1,700.00	0.23
(h) Miscellaneous pumps, tanks, etc	600.00	0.08
(i) Boiler room instruments, controls	7,800.00	1.04
(j) Piping	35,300.00	4.71
(k) Turbine-generator unit and auxiliaries	152,000.00	20.25
(l) Electric wiring and switching	9,300.00	1.24
Totals	$320,000.00	$42.65

The total generating capacity of the plant is 16,000 kw., and a 6,000-kva. interconnection with the Montaup Electric Company and New England Power Association systems is provided at the station. The new unit generates energy at 13 kv., and two buses are provided for normal and emergency service. The older units generate at 2,300 volts and feeders at this potential deliver energy to many local customers. A 5,000-kva. transformer bank ties the 2,300-volt and 13-kv. buses together and a 13-kv., three-phase alternating-current network delivers energy to various substations and large customers on the system, the higher voltage feeders being installed with circuit breakers and disconnecting switches permitting operation on either of the two 13-kv. buses.

The plant addition is a part of a general scheme on which study was started about three years ago to achieve more economical production of energy for the system, combined with the sale of steam and electric service to manufacturing plants in Taunton. The majority of the combined steam and power customers are located within 0.5 mile of the station. Extraction steam will be sold to the mills through a pipe line to be in operation for the group of fourteen mills this fall. The sale of steam (and electrical energy) is to be carried out on a basis of rates which will accomplish considerable savings to the customers. It will relieve the various manufacturing plants from boiler plant upkeep and in a number of cases will relieve them of the necessity of investing in new boiler plant equipment.

•

Appliance Sales Net $7,128,179 in Revenue

Sales of domestic appliances by the operating companies of the Commonwealth & Southern Corporation during the first eight months of 1934 totaled $7,128,179. This broke all records for the system. Eighty per cent of these appliances were sold on the deferred-payment plan. As a result of this increased residence-used electricity the total residence consumption during the month of August, 1934, was 24.77 per cent greater than in the same month the year before. Owing to reductions, however, and to some extent to an increased usage in the lower steps of the rate schedules, receipts from residence customers only totaled 7.51 per cent greater than the year before.

•

Turbines for College Plant

Two 1,500-kva., 3,600-r.p.m., steam turbines have recently been installed in the power plant of the University of Texas by the Westinghouse Electric & Manufacturing Company. These turbines surpassed performance expectations and guarantees by quite a little margin when placed on the line. The university has a very modern electrical system all the way from the power plant to the last lighting outlet.

GOVERNOR TALMADGE LIKES ELECTRIC COOKING

Down in Georgia they have been turning to (and "on") electricity for cooking and water heating since rates were reduced, so Governor and Mrs. Eugene Talmadge felt right at home when they found this modern Hotpoint range in the bungalow atop the skyscraping Morrison Hotel, where they stayed during their visit to Chicago's 1934 Century of Progress Exposition. The fact that Georgia Power Company alone will install some 3,000 electric ranges and 1,000 electric water heaters in Georgia homes this year is pointed to by the Governor as an example of improved conditions and raised standards of living in his state. Louis Pannetier, executive chef of the Morrison, took pride in demonstrating to Mrs. Talmadge and the Governor that not all the good cooking is done in the South.

Sight-Saving in Classrooms Adopted by Many Schools

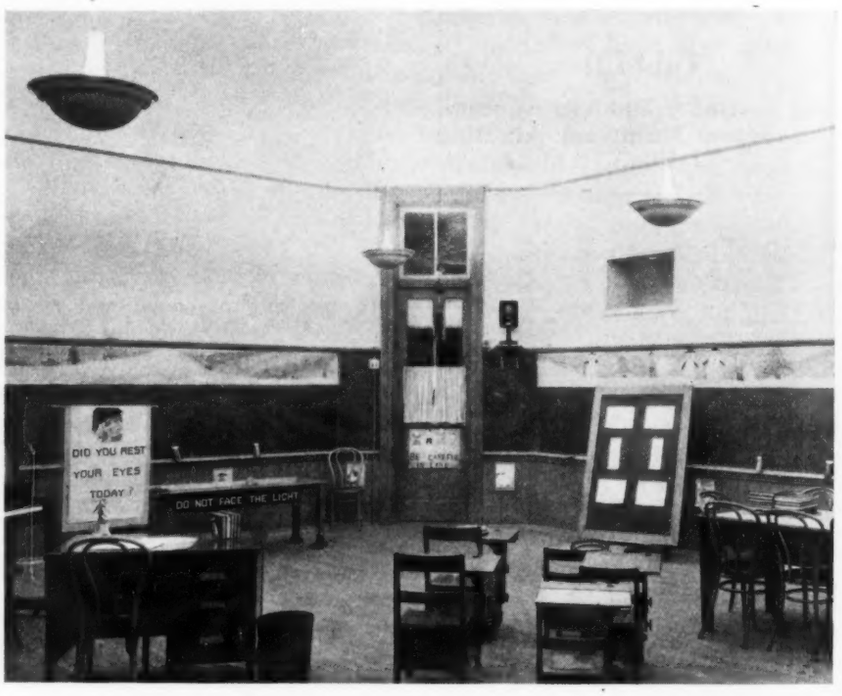
Two examples of good school illumination with 35 foot-candles average on the desks and 15 on the blackboards — Both are automatically controlled by photocells.

By WALTER STURROCK and KARL STALEY
Illuminating Engineers
Engineering Department, General Electric Company, Nela Park, Cleveland

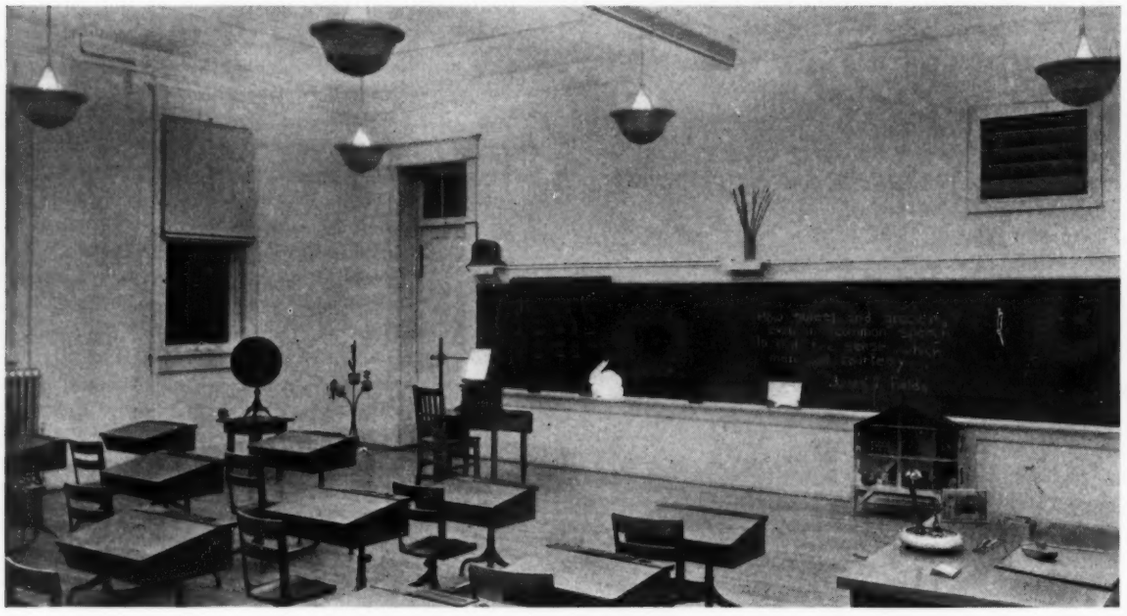
FOUR HUNDRED sight-saving classes have come into being during recent years in recognition of the fact that more than 5,000 of our public school children are more than half blind. These children are segregated into classes specially equipped with better seeing facilities, both in the visual task itself and the lighting facilities. Two examples herewith demonstrate high level diffused illumination which assists visually those with subnormal eyesight. The average level of illumination of 35 foot-candles is quite in contrast with the customary average of only 1½ to 8 foot-candles in the regular classroom when electric lighting is used.

Requirements for admission to these special classes differ in different states, but generally the children are less than "half seeing." Every effort is taken to reduce the difficulties of their ocular work. Pupils are advised constantly about their reading posture. Work from standard books is read to them, and books with special large print are given them for supplementary reading. They spend approximately two-thirds of their time here and report to regular grade rooms for recitations.

In the two illustrations shown of sight-saving classrooms with greatly improved lighting facilities 750- and 1,000-watt lamps in indirect luminaires are employed. The spacing of the units averages 100 to 150 sq.ft. per outlet and the resulting illumination is 30 to 35 foot-candles. Ceilings are white and walls light in color. In both photo-electric control equipment is used to turn on lights when the light level falls to 15 foot-candles on the desk tops on the blackboard side of the room.



Totally indirect 1,000-watt mat aluminum units are employed at the Waring school, Cleveland

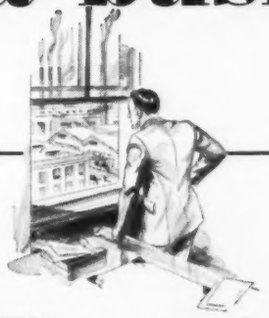


Six units spaced on 11 x 14⅓ ft. centers produce an average level of illumination of 35 foot-candles. The room is 27⅓ x 34 ft. with 13½-ft. ceiling. The board illumination is 14 foot-candles.

Nine mirrored glass units are used in this room in the West Fifth Street school, Mansfield, Ohio.

These luminaires are on 10 x 10-ft. centers. The 750-watt lamps produce 32 foot-candles on the desks, 15 foot-candles on the blackboards.

Why does any man start a business?



"BECAUSE HE HOPES TO MAKE MONEY," you say. True, just as the men of the Covered Wagon hoped to find gold or richer soil. But there is another reason. A man lives only once. There is inside him a restless urge to *do* something, to *build* something, to have something to show for the years of his life. So he gathers his courage and jumps. And having taken the jump he finds that he has kissed good-bye to ease and peace for a long long time.

Skilled workmen alone cannot operate a business. There must be a leader. He must organize a process, train employees, search the world for raw materials, win recognition and acceptance in the markets, meet the daily menace of competition, find each week the pay for hundreds who could not live without it, shoulder the heavy load of taxation, and finally earn a fair return for those who have trusted him with their savings.

The higher up he gets the harder it is to stay. For any business is a growing, living organism. It is never completed . . . never safe.

What does it get him?

By actual statistics, he has one chance in a hundred of moderate wealth; one chance in four of a living; a bare chance of keeping the business going for more than six years.

And as he succeeds, the affairs and responsibilities of the community are added to his load. With others he is expected to plan and work to make his a better city . . . with better streets and schools, fewer slums, a finer hospital, more useful churches, less sickness and hardship.

During the past four years, thousands of business men have lost all that they made in prosperous years because they refused to close up unprofitable enterprises and throw employees out of work. There are few who would not be vastly better off today if they had quit four years ago and bought government bonds.

But the kind of man who starts a business is rarely a quitter. He may fail, but he doesn't curl up. He is not a vocalist. As a general thing he takes abuse without much grumbling or complaint. If he is beaten, he gathers the pieces together and tries again.

In a recent editorial, Bruce Barton quoted a prominent business man as follows: "Our point of view is that the *times are the times*. We cannot change them. We can only accept them and keep busy trying to better our products and adapt our methods to whatever conditions prevail."

In the business men of America lives the spirit that made America. It is their courage and enterprise and faith which built our cities, created vast utilities, erected industries employing millions, and brought about a manner of living and a horizon of opportunity which the world had never known and knows nowhere else.

Remington Rand is proud of the part that it plays in aiding business men to get facts. Because Remington Rand manufactures every type of record form, equipment, typewriter and accounting machine, it can accept full responsibility for organizing and installing a complete business method, each part of which functions economically.

The Remington Rand man has nothing to sell except a satisfactory result. He can advise without bias because he represents a *complete* range of office machines and equipment. He is backed by experience that enables him to prescribe intelligently and without guesswork.

No business, small or large, can fail to gain by consulting this organization. There is a Remington Rand man within reach of your telephone—offices in all principal cities. Remington Rand Inc., Buffalo, N. Y. (Canada: 68 King St., W., Toronto.) World's largest manufacturer of office equipment.

Remington Rand

BUFFALO, NEW YORK

Housing Program Lists Electrical Improvements

The Federal Housing Administration has issued a series of handbooks for the promotion of its better housing program. Excellent presentation is given to the possibilities for improvement in the electrical equipment of a house as a feature of modernization.

In a booklet for owners of homes and business property, after explaining the program and conditions under which government loans can be secured, a check list is given which the owner can use in studying the possibilities for improving his property. The list suggests well-placed lights and switches on the basement stairs to prevent accidents and lights in dark corners. Under interior equipment it recommends a built-in dishwasher, built-in cooking and refrigeration equipment and adequate wiring outlets for the kitchen, new lighting fixtures for the bathroom and ventilating fans for the attic that is too hot for habitation.

Under a section headed "For Convenience, Sanitation and Comfort" it suggests a check-up on the location of all lighting fixtures and the installation of additional outlets in the proper spots. It points out the value of lights in closets, in attics and attic stairs and recommends insulated fixtures in the kitchen and bathroom as a measure of safety, also ample lights in the garage. In the section on the farm well-lighted poultry houses that stimulate egg production are listed, and for business properties, the replacing of obsolete lighting fixtures and the installation of ample outlets to serve the needs of all employees.

A handbook for architects, contractors, building supply and other merchants lists the following built-in equipment, which is approved for insured loans:

Individual lighting plants and equipment.
Domestic water heating equipment, if nondetachable.
Lighting fixtures, if an integral part of the wiring.
Air-conditioning equipment, if built in.
Humidifying equipment, if built in.
Built-in ventilating equipment, including fans.
Fire and burglar alarm systems.
Electric ranges, if permanently attached to the wiring system.
Electric refrigerators, if permanently attached to wiring system.
Electric clothes washers.

Electrical equipment listed as not eligible for insured loans includes:

Radios (unless built in).
Electric fans (unless built in).
Electric irons.
Electric ranges (unless built in).
Food-mixing machines.
Vacuum cleaners (unless built in).
Individual detachable electric heaters.
Single - unit air conditioners (unless built in).

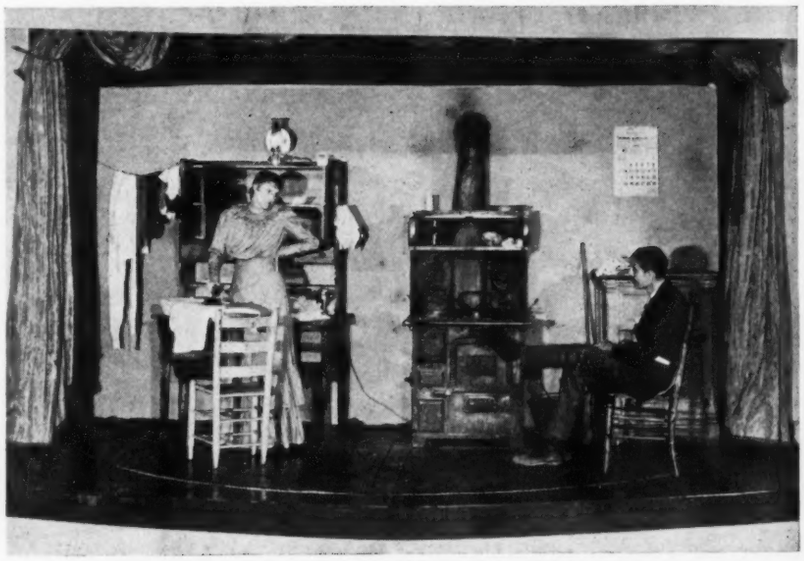
A handbook on the organizing of community campaigns, listing the total value of work done in a large midwestern city during a local modernization campaign last year, shows $39,561 spent for electrical work in a total of $1,086,595 expended for all purposes, or 3.6 per cent spent for electrical construction.

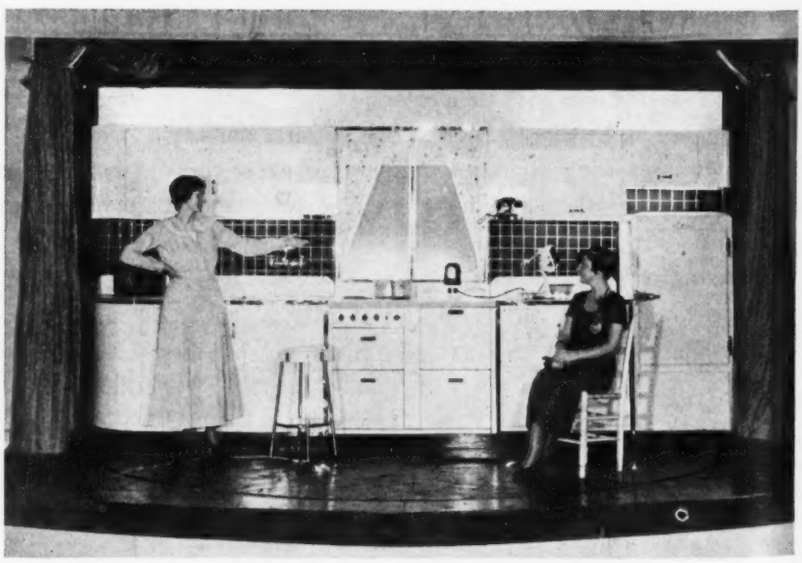
C. E. Greenwood, commercial director of the Edison Electric Institute, is serving as an industry adviser with the Federal Housing Administration and has guided the development of the electrical features of the program.

New Company Organized to Make Motors

F. S. Kingston and B. L. Conley, both well known in the electrical industry, have organized the Kingston-Conley Electric Company to manufacture high-grade fractional-horsepower heavy-duty motors. The factory is located in Jersey City, N. J. The company is made up of a group of experienced executives and workmen who have been in the business of manufacturing fractional-horsepower motors almost since their inception.

CHATTANOOGA GLIMPSES THE ELECTRIC KITCHEN





When Chattanooga's Chamber of Commerce celebrated the opening of the Electric Home and Farm Authority's display rooms there was a dinner and it was enlivened by a skit. The Tennessee Electric Power Company's talent rigged up an old-fashioned kitchen to contrast with one of the electrical age. Our guess is that they were mounted back to back on a revolving stage. In the twinkling of an eye the exchange was made, symbolic of the transformation which E.H.F.A. has in mind for the region. Please overlook the wires to the "kerosene" lamp. That's poetic license for the sake of the effect

"THE FROST IS ON THE PUMPKIN

—and the fodder's in the shock!" . . . 'Tis the season of pumpkin pie and keen appetites at meal time. At this season, more than any other, folks respond to the food appeal, so delectably presented by the Electric Range. And never has the range had the publicity nor growing public acceptance, that it now has. So, now is the time to promote electric range sales. . . . The range is now better than ever before, because of improved design, and the doubly increased life of their CHROMEL units. When you specify Chromel for the range units, you call for the alloy that made the range possible, the same Chromel that thus created your profitable heating-load. You confirm the judgment of the range maker, when you specify Chromel for the units. (For our handy Heating-Unit Calculator, ask for Form KW.) . . . Hoskins Manufacturing Co., Detroit, Michigan.

HOSKINS

CHROMEL

WIRE

The Alloy that made Electric Heat possible

Reorganization Announced for Gears & Forgings, Inc.

Reorganization under the name of Ohio Forge & Machine Corporation has been effected for Gears & Forgings, Inc., which has been in receivership since April 1, 1932. The new company will operate the former Ohio Forge and Van Dorn Dutton divisions of Gears & Forgings, Inc., located on adjoining properties at Cleveland, Ohio. Many of the officials who will direct the new company were formerly identified with Gears & Forgings, Inc. F. H. Chapin, president of the National Acme Company, will be chairman of the board. Other officers include S. C. Dalbey, president; J. M. Clem, vice-president; H. B. Newell, executive vice-president; T. E. Leighton, secretary and treasurer; R. B. Tripp, general sales manager.

The new company will be equipped to handle all types of gearing in a wide range of sizes, power transmission equipment of all descriptions, a full line of speed reducers from fractional horsepower to 500 hp., and special machinery.

•

Major Retail Outlets Boost Kelvinator Sales

Sales of Kelvinator refrigerators through major retail stores were 261 per cent greater for the first three quarters of its current fiscal year than during the corresponding 1932-33 period, V. J. McIntyre, manager of the department store division of Kelvinator Corporation, announced recently.

"This gain in sales accompanied a 177 per cent increase in the number of major retail accounts," Mr. McIntyre stated, "and reflects, therefore, the growing importance of department stores, furniture houses, outfitting companies and music concerns in the marketing of the Kelvinator line."

•

Plan Check Up for Power Prospects

An unusual approach to industrial prospects has been organized by the Public Service Electric & Gas Company of New Jersey. A series of check sheets has been prepared to stimulate a general check up of plant facilities and methods. There are eight sheets, listing in all 106 check points under the following heads:

Eliminate delays.
Cut overhead.
Improve performance of production equipment.
Improve efficiency of auxiliary equipment.
Improve products.
Check your working conditions.
Preventive maintenance.
Prepare for expansion.

The power salesman takes these check sheets to the prospect and interests him in making a thorough study of his plant. Questions relating to electrical equipment are scattered through the sheets in their proper relation to the general problem. The check up is made by the prospect's own superintendent. The salesman calls back to find out the results and if any question has arisen affecting electrical conditions in the plant, the services are offered of special representatives on power, lighting, trucks, combustion, industrial fuel and air conditioning. A complete canvass of all power prospects will be made on this basis. The work is now just starting.

Borg-Warner Acquires Detroit Vapor Stove

Confirming persistent trade rumors, Howard E. Blood, first vice-president Borg-Warner Corporation and also president of its subsidiary, Norge Corporation, has announced the acquisition of the Detroit Vapor Stove Company. The Detroit Vapor Stove Company will operate strictly as an independent Borg-Warner subsidiary and its management, organization and distributive methods will remain unchanged.

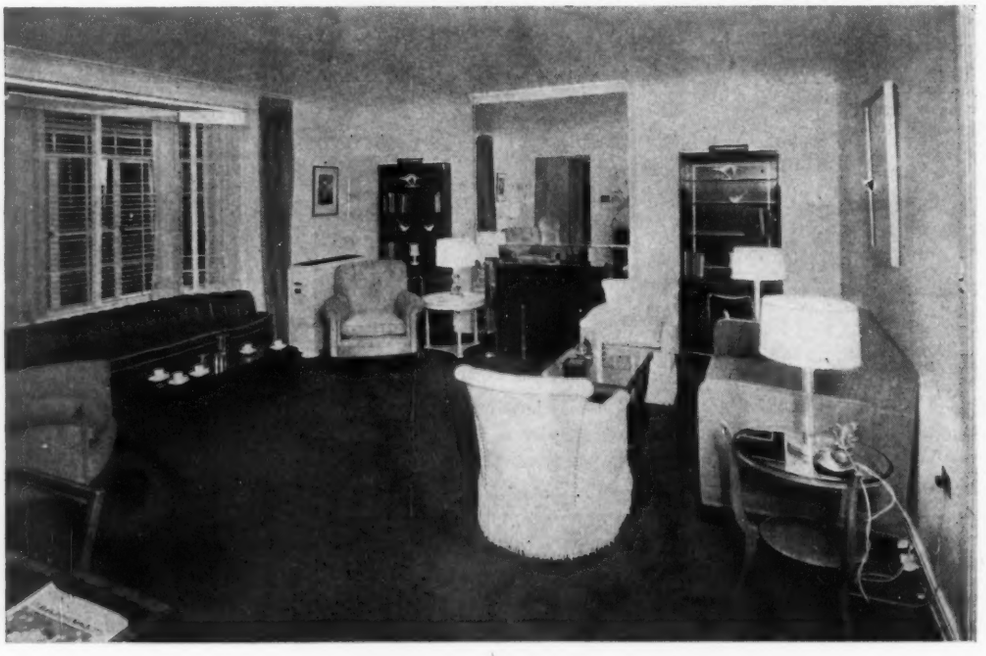
"Norge experience, during its rapid rise to a position among the leaders in the refrigeration industry, inspired the Borg-Warner desire to take full advantage of the trend toward complete kitchen planning," Mr. Blood stated. "This led to the acquisition of Detroit Vapor Stove Company, which is the last major link needed to round out its kitchen appliance lines."

•

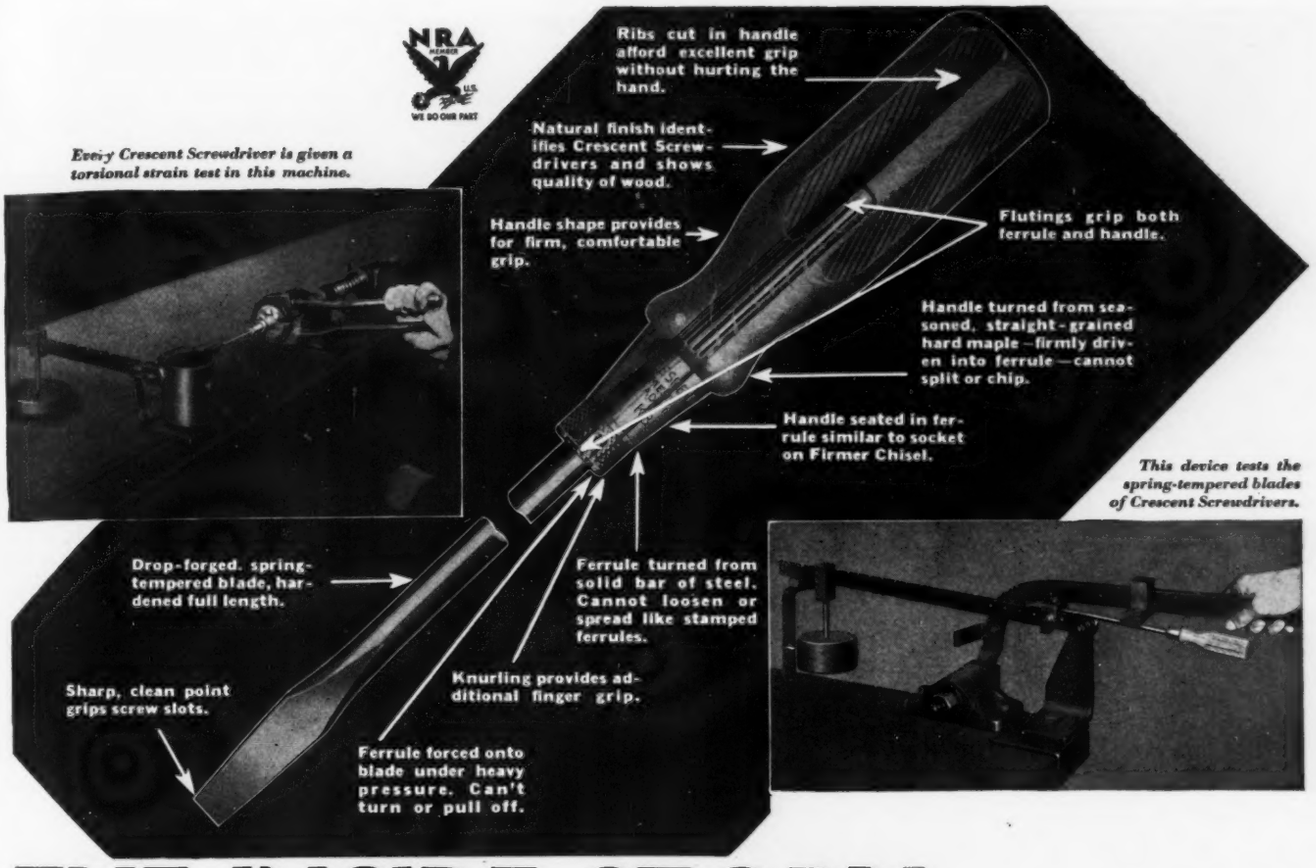
Rex Cole Sales Increase 10 per Cent Over Last Year

Dollar sales of the various products handled by Rex Cole, Inc., have shown a 10 per cent increase for the first eight months of this year, as compared with the corresponding period of 1933, according to a statement made recently by E. Hamilton Campbell, sales promotion manager of the company. Mr. Campbell is looking forward to a continuation of good business through the fall. The company's refrigerator advertising campaign, he said, is being continued in October, and still another campaign will be started in the near future featuring laundry equipment.

INDUSTRY PROMOTION FOR AIR CONDITIONING



Cleveland's permanent Building Arts Exhibit, known locally as "The House in the Sky," suggests the possibilities for developing co-operative promotion for domestic air conditioning. Air-conditioning equipment has been made a conspicuous feature of this room, through the efforts of H. H. Kennedy, local manager for Frigidaire. For the past four months the model home has been made cool and comfortable to an average of 1,000 visitors daily.


NRA
MEMBER
U.S.
WE DO OUR PART
Every Crescent Screwdriver is given a torsional strain test in this machine.
Ribs cut in handle afford excellent grip without hurting the hand.
Natural finish identifies Crescent Screwdrivers and shows quality of wood.
Handle shape provides for firm, comfortable grip.
Flutings grip both ferrule and handle.
Handle turned from seasoned, straight-grained hard maple—firmly driven into ferrule—cannot split or chip.
Handle seated in ferrule similar to socket on Firmer Chisel.
This device tests the spring-tempered blades of Crescent Screwdrivers.
Drop-forged, spring-tempered blade, hardened full length.
Ferrule turned from solid bar of steel. Cannot loosen or spread like stamped ferrules.
Sharp, clean point grips screw slots.
Knurling provides additional finger grip.
Ferrule forced onto blade under heavy pressure. Can't turn or pull off.

THE INSIDE STORY *OF A BETTER SCREWDRIVER*

No. K101½ 30c
Also No. K201½, with rod thru handle 35c

No. K300 Series . . . . . 30c to 80c

No. K400 Series . . . . . 35c to 85c
Same as K300 except that rod extends thru handle

No. K500 Series . . . . . 35c to 60c

No. K600 Series . . . . . 40c to $1.10

All series except K100 and K200 available in 2 to 12 inch blade lengths.

MANY people think of a screwdriver simply as a tool with a steel blade and a wood handle.

An analysis of the Crescent construction pictured above clearly indicates the reason why there are screwdrivers *and screwdrivers.*

Crescent Screwdrivers are quality built thruout. No short cuts in manufacture are permitted which will in any way endanger the performance of the tool. Crescent *spring-tempered* blades will stand years of service and a great deal of abuse. Handle assembly is such that blade slippage is impossible. Thorough factory testing is your assurance against defective material or workmanship.

If you want the economy which only better, longer-lived tools can supply, specify Crescent Screwdrivers. Available through your supply house in a wide range of patterns and sizes—all fully guaranteed.

CRESCENT TOOL CO.
Jamestown, N. Y.

CRESCENT and Smith & Hemenway TOOLS

Can you answer all these questions on Storage Batteries?

1 What important factors influence the choice of one of the three Modern Gould Stationary Batteries?

2 Why does the Gould method of manufacture produce Planté plates which are free from mechanical and electro-chemical service failures?

3 In what way does the practical achievement of the theoretical design, result in the remarkable performance so characteristic of Gould Armored Kathanode Batteries?

4 Why is the Gould Dreadnaught Battery an outstanding product in the paste plate field?

FREE WORKING MANUAL ANSWERS ALL QUESTIONS ON LATEST TYPES OF BATTERIES

For Purchasing Agents, Operating Executives, and Engineers, . . . Gould has just completed a comprehensive manual on Storage Batteries for Stationary Applications. This new publication, Bulletin No. 950, will help you decide which type of battery best fits your individual requirements, . . . Gould Planté Paste . . . Gould Armored Kathanode . . . or Gould Dreadnaught. Mail the coupon for your free copy of Bulletin No. 950.

GOULD

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GENERAL OFFICES AND FACTORY, DEPEW, N.Y.

Sales Offices in the Principal Cities of the U.S.A.

FREE MANUAL COUPON

Gould Storage Battery Corporation
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Please Send me your comprehensive battery manual No. 950 covering Stationary Sealed In Glass Types.

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Company _____

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Britain Refuses to Raise Japanese Bulbs Duty

In what is held to be a move indicative of Anglo-Japanese rapprochement, the British government has refused to impose a higher rate of duty on electric light bulbs imported into that country, although such action was advocated by its Import Duties Advisory Committee. The report of the committee pointed out that English manufacturers have suffered for several years from foreign competition.

Japan is by far the most important foreign supplier of the British market. British imports of light bulbs numbered 50,748,095 valued at £168,893 in 1932, 54,487,127 valued at £179,319 in 1933 and 33,139,747 valued at £108,669 in the first six months of this year. In failing to impose the higher specific duties suggested by the Import Advisory Committee the British government is reported to have based its action on an agreement with Japan that imports from that source will not exceed 4,300,000 lamps of 20 volts or over, 5,600,000 motor vehicle lamps, 22,800,000 flashlight lamps and 1,100,000 fancy lamps in the twelve-month period beginning April 1, 1934.

HOME MODERNIZATION SHOWS FEATURED BY UTAH

To capitalize present interest in the government housing program, the Utah Power & Light Company has been featuring a modernization exposition in various centers of its territory. The first modernization show ran in Salt Lake City May 15 to June 30 and 121,000 people attended. The Western Colorado Power Company, as a subsidiary, ran a similar exposition at Delta, population 3,000, and 14,000 people viewed the display within two weeks. In addition a traveling exposition has been covering the smaller communities and in the first three months has appeared in 53 rural centers and was visited by 4,600 people. In some towns the entire population turned out. These expositions feature domestic lighting for eye conservation, household appliances and electricity on the farm, as well as demonstrations of window and store front lighting and a topographical model of the territories served by the Utah system.

Frigidaire has never believed in half-way measures and never will.

That's why General Motors has spent millions of dollars in research that Frigidaire may continue to be known as the leading product of its kind. That's why millions of dollars have been invested in new plants and equipment that each Frigidaire may be as nearly perfect as it can be made. That's why the vast purchasing power and the engineering skill of General Motors have been called upon to make Frigidaire, in every sense, a true General Motors value.

As a result, Frigidaire today enjoys a reputation that is clearly reflected in Frigidaire sales. Aggressive in its policy of product improvement—aggressive in its advertising and merchandising methods—Frigidaire has steadily strengthened its position in the industry while company after company has come into the business and gone out again.

Frigidaire's two-fisted leadership—in quality—in value—and in sales—has won the approval of the foremost Public Utility Companies of the country. These companies have found that Frigidaire is the electric refrigerator that sells easily and stays sold—that builds real profits for their merchandising departments.

Frigidaire's sales program for 1935 is being formulated now.

It will be the most comprehensive in the company's history. It will embody new ideas and plans of the greatest importance to every man interested in the profits to be made from the sale of electric refrigerators.

If you, too, like General Motors, have "an eye to the future—an ear to the ground," it will pay you to get all the facts about Frigidaire's 1935 sales program. Write to Frigidaire Corp., Subsidiary of General Motors Corp., Dayton, O.

Frigidaire

A PRODUCT OF GENERAL MOTORS

THE WORLD'S MOST POPULAR ELECTRIC REFRIGERATOR

A NEW
ANNUAL LOAD OF MILLIONS OF Kw-Hr.
Electricity for Plant Growth

A PROFITABLE LOAD

This new load is profitable, (a) to the central station because it consists of electric light and heat (a high-power-factor load), is principally an off-peak load, and is supplied at standard rates; and (b) to the grower because it assures faster plant growth and better control of production, provides more certain results, and reduces cost of labor.

EQUIPMENT EASILY SOLD

The electric equipment can easily be sold because of its low first cost and ease of installation. It is entirely practical and will produce real profits for the user.

JUST PUBLISHED

"Modern Methods for Growing and Marketing Flowers and Vegetables" is a new bulletin which describes the latest practices for using electric light and heat in plant production. Here are some of the important topics covered in this publication:

Soil Heating
Soil Sterilizing
Light for Stimulation and Control of Plant Growth

Request your copy of this new informational bulletin by sending the coupon below to the nearest G-E sales office, or to General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

General Electric Company
Dept. 6—201, Schenectady, N. Y.

I should like to receive a copy of your publication GEA-1644C on "Modern Methods for Growing and Marketing Flowers and Vegetables."

NAME .....
COMPANY .....
ADDRESS .....

521-7

An Electrified Aqueduct

[*Continued from page 41*]

a second 66-kv. transmission line extending from Colton to Cabazon.

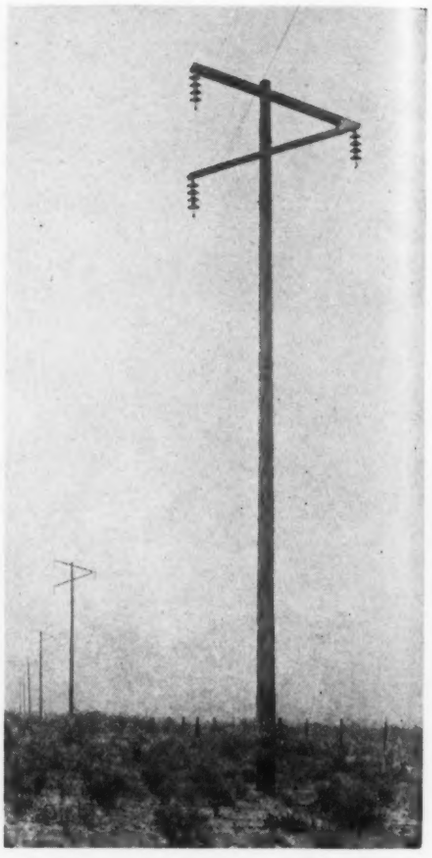
The lines east of Cabazon are protected by instantaneous overcurrent relays set to care for faults occurring in 80 per cent of each section. They are, of course, supplemented by a conventional installation of inverse-time overcurrent relays. By the use of the instantaneous relays clearances have been obtained as quickly as 9 cycles, which minimizes the tendency for synchronous equipment to drop off the line on the voltage dip.

In the loop between Colton and Cabazon phase directional relays are used, and also ground-directional relays receiving their potential from capacity taps in the switch bushings. Sufficient experience has not yet been obtained to determine the merits of the latter installation.

The construction power system has a very creditable operating record. Accidental interruptions have affected only small portions of the system and there have been only two general shutdowns due to failure of the power supply. A summary of the accidental interruptions during the first fourteen months of operation is given in Table I.

Construction costs are low

Construction of the lines and substations was practically all accomplished by contract. Work was begun in January, 1933, and completed to the Colorado River on October 13, 1933. During that period 446 miles of circuit was constructed, which is slightly more than 1½ miles per day. In doing this work more than 400 carloads of material were moved from the railheads to location, much of it over desert where roads were extremely poor, if not lacking entirely. A great deal of the hauling and construction was done during the summer with temperatures ranging up to 125 deg., which also added greatly to the difficulties of the work. Due to the prevailing low prices for material during this period construction costs were considerably below the estimates, the 66-kv. No. 4/0 copper circuit varying in cost from $2,000 to $3,000 per mile and the 33-kv. No. 2/0 copper circuit from $1,600 to $2,400 per mile. The transmission substations of 6,000 kva. capacity, without condensers, cost approximately $70,000 each, and including the condensers the maximum cost was $116,000. Total cost of the power system, including surveying and engineering administration, was about $1,800,000.



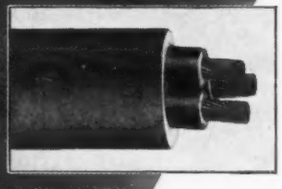
Wishbone construction on 66-kv. line

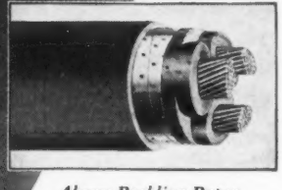
Power is sold to the construction contractors at the rate of 1 cent per kilowatt-hour, provided the average power factor of the contractor's load is 95 per cent, or better. If the average power factor falls below 95 per cent, 0.04 of a mill per kilowatt-hour is added to the rate for each per cent by which the average power factor falls below 95 per cent. This penalty for low power factor has been sufficient to induce nearly all of the contractors to install synchronous motors and other equipment of high power factor. The average rate being paid by the contractors is approximately 1.03 cents per kilowatt-hour. Three synchronous condensers located at district substations have been operated as required to reduce the monthly power bills to a minimum. The power factor of the entire district load has been such that the maximum power factor discount of 10 per cent has been applied to all monthly bills. In addition, excellent voltage regulation has resulted from the high power factor of the contractors' loads.

ROEBLING
Varnished Cambric
CABLES

The Roebling Varnished Cambric Cable shown above is 3-conductor, lead encased. It is merely one of many types of varnished cambric cables made by Roebling.

These Roebling Cables are available in single, two and three-conductor types; for a wide range of voltages; in gauges from No. 14 B. & S. to 2,000,000 circular mils. Braided or leaded. Also with steel, zinc or bronze tape, or round wire steel armor.





Above: Roebling Paper Insulated Cable.

Top: Roebling Rubber Insulated Cable.

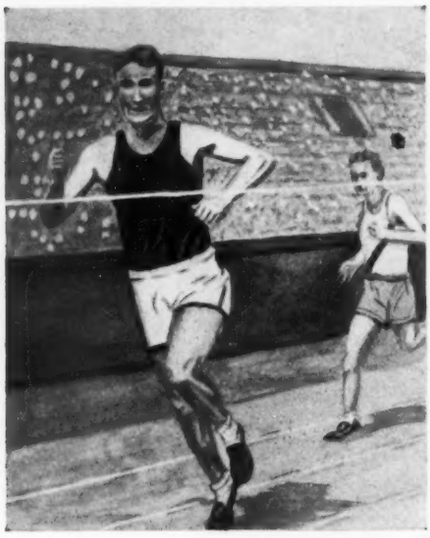
OVER 60 OTHER TYPES

Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Slow Burning Wires and Cables » Weatherproof Wires and Cables » Submarine Cables » Portable Cords » And a wide variety of other wires and cables.

JOHN A. ROEBLING'S SONS CO., TRENTON, N.J.
Branches in Principal Cities

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING JAR

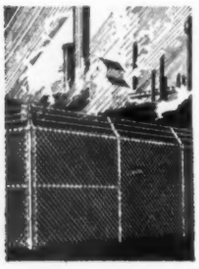
ENDURANCE



THE ABILITY to withstand the steady destroying effects of weather and the strength to give effective service years longer are built into every Cyclone Fence. Endurance is one of the factors which determines a real fence value, it is an essential feature.

For nearly half a century Cyclone Fence Company has been manufacturing Property Protection fence of the highest quality. Most of the improvements which have been made on chain link fence have originated in Cyclone factories. Improved erection methods and direct control of erection crews are policies which insure the proper erection, increase its endurance and add years to the life of Cyclone Fence.

An accurate estimate will convince you of the economy of enclosing your property with Cyclone Fence. It will soon pay for itself by eliminating the possibility of theft, damage and liability suits. Write for catalog today. Address Dept. E. W.



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General Offices: Waukegan, Illinois
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
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Pacific Coast Division:
Standard Fence Company
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Cyclone—not a "type" of fence, but fence made exclusively by Cyclone Fence Company and identified by this trade-mark.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of new work. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

KANSAS CITY, KAN.—Plans installation of motors and controls, electric hoists, conveyors, elevators and other equipment in new city-owned dock and grain elevator on Missouri River levee. Cost about $2,000,000. Financing has been arranged through Federal aid. Horner & Wyatt, Board of Trade Building, Kansas City, Mo., consulting engineers.

DEARBORN, MICH.—Ford Motor Company is having plans drawn for new power plant, 40x150 feet, by Giffels & Vallet, Inc., Marquette Building, Detroit, consulting engineers, to be used for service at new steel mill addition, 270x920 feet, for which plans will be prepared by same engineers. Total cost over $7,000,000.

WASHBURN, ME.—Quebec Extension Railway Company, Quebec, Que., plans construction of electrified railway line from Washburn to Lac Frontier, on United States-Canadian boundary, about 90 miles, including feeder lines, power substations and switching stations. Cost about $4,175,000. Financing is being arranged.

NEW CASTLE, PA.—Plans new city-owned electric light and power plant. A bond issue of $3,750,000 is proposed.

CINCINNATI, OHIO — Gulf Refining Company, Pittsburgh, Pa., plans installation of motors and controls, electric pumping machinery, etc., in new bulk oil storage and distribution plant at Cincinnati. Cost close to $100,000.

GRAND ISLAND, NEB.—Asks bids until October 17 for feeder circuit panels and other equipment for city-owned electric station.

MENOMINEE, MICH.—Has concluded arrangements for Federal loan and grant of $803,000 for new city-owned electric light and power plant. Work on project will proceed at early date.

ESCONDIDO, CALIF.—Escondido Orange Association plans installation of motors and controls, conveyors, loaders and other equipment in new citrus fruit packing and distribution plant. Cost $130,000. W. W. Ache, 1616 Fourth Avenue, Los Angeles, Calif., is architect.

HARLINGEN, TEX.—Cameron County Water Improvement District No. 19, Keith McCanse, president, plans large electric-operated pumping plant on Rio Grande River for water supply for district, and will purchase two motor-driven 30-inch pumping units, with controls, panel boards, feeders, etc. Bonds for $471,000 have been sold for entire project.

GREELEY, COLO.—Home Gas & Electric Company plans two new 22,000-volt transmission lines, from Greeley to Ault and vicinity, and from Greeley to Peckham, about 22 miles total. Cost about $60,000.

CHICAGO, ILL.—Dearborn Paper Company, 860 Rees Street, plans installation of motors and controls, conveyors, etc., in new local paper converting plant. Cost about $85,000.

BROOKLYN, N. Y.—Signal Supply Officer, Army Base, asks bids until October 22 for power panels, with meters, fuses, switches, etc. (Circular 31).

ELBERTON, GA. — American Granite Quarries, Inc., Atlanta, Ga., plans installation of motors and controls, conveyors, electric cranes and other equipment in new fabricating and finishing plant at Elberton. Cost over $75,000.

CINCINNATI, OHIO—Kroger Grocery & Baking Company has plans for new power plant, and soon takes bids for equipment. Cost about $135,000. Fosdick & Hilmer, Union Trust Building, are consulting engineers.

BREMERTON, WASH.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., asks bids until October 23 for 12 lower power hoist control equipments, 18 push button stations, and accessory equipment for Puget Sound Navy Yard (Schedule 3477).

SACRAMENTO, CALIF. — Sacramento Utility District, Albert Given, Sacramento, chief engineer, votes on bond issue at general election, November 6, for $12,000,000 for hydroelectric generating plant, power substations, transmission and distribution lines for entire district, including purchase of certain existing properties and new construction. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

BOUNTIFUL, UTAH—Has arranged for bond issue of $156,000 for new city-owned electric light and power plant, using Diesel engine-generating units, and for purchase of existing electrical distribution system of Bountiful Light & Power Company; extensions and improvements will be made in latter. Proposed to begin work soon.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, asks bids until October 25 for one 85-ton gantry crane for installation in new Wheeler power plant.

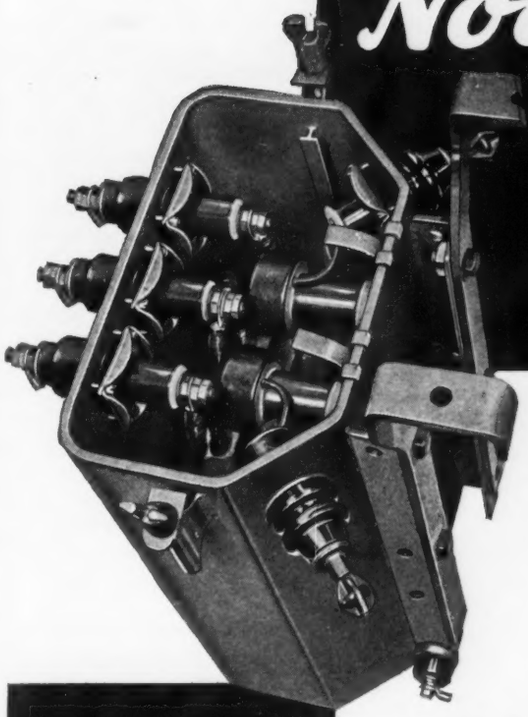
RENO, NEV.—Amador Mother Lode Mining Company, care of O. E. Chaney, Reno, president, recently organized, plans installation of motors and controls, electric hoists, loaders, conveyors, etc., for development and operation of gold-mining properties. Stock issue of $200,000 is being arranged, considerable portion of fund to be used for purpose noted.

STOCKTON, CALIF.—Pacific Can Company, San Francisco, plans installation of motors and controls, hoists, conveyors and other equipment in new plant at Stockton. Cost over $100,000.

PAWNEE, OKLA.—Asks bids until October 24 for equipment for city-owned electric light and power plant, including two 450-bhp. Diesel oil engines with electric generators, exciters and complete accessory equipment (Section 1); complete switchboard and electrical equipment (Section II). W. R. Holway, 302 East Eighteenth Street, Tulsa, Okla., is consulting engineer.

MARSHALL, MO. — Plans extensions and improvements in city-owned electric light and power plant, with installation of new generator unit and accessory equipment. Estimates of cost being made. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., consulting engineer.

BENTON HARBOR, MICH.—Motors and controls, conveyors, electric hoists, refrigerating machinery, air compressors and other equipment will be installed in new cold storage and precooling plant at Benton Harbor, for company now being organized, headed by George H. Kittredge, care of George B. Bright, 2613 Twelfth Street, Detroit, Mich., engineer. Cost approximately $75,000.



Now MODERNIZATION GIVES YOU NEW *Low Cost* TRANSFORMER PERFORMANCE

OUTAGE-FREE

TYPE SB DISTRIBUTION TRANSFORMERS

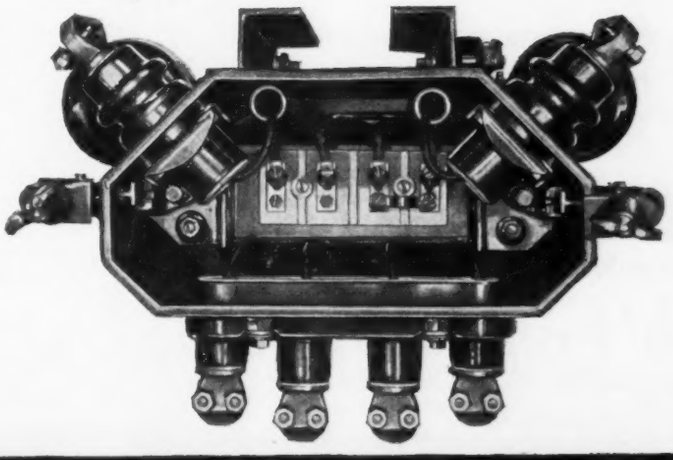
DOUBLE protection is given the windings of this new line of distribution transformers. This is accomplished by Surge Diverters and the Co-ordinated Bushing Construction. The net result is outage-free performance.

The Surge Diverters are mounted either internally (see top illustration) or externally as shown at left. This type of protection shunts the Surge to the ground with the result that there is no fuse blowing and service is not interrupted.

The bushings are so designed that in the event of a lightning surge or other transient voltage condition, flashover will occur outside of the tank from the bushing terminal to the tank.

Co-ordinated Low Voltage Bushings

One piece mounting. The leads from the transformer windings consist of insulated cables which are brazed to stud terminals located well inside of the porcelain bushings. This construction eliminates bare wires or terminals above the oil level inside of the transformer case. Flashover therefore will not take place inside of the case, and the hazard of igniting oil vapor inside the transformer tank is eliminated.



Send for Booklet

Booklet No. 2166 presents a very complete story of this Outage-free line. Send for it now and see in detail why these transformers are money saving.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

Nature Grew Durable
Western Red Cedar
Weyerhaeuser
Skill Has Formed It
Into Serviceable Poles

Western Red Cedar needs no introduction to you as nature's most durable, dependable wood for pole service.

But there are important steps between Weyerhaeuser's great stands of virgin cedar and the delivery to you of satisfactory poles from convenient storage yards.

These steps are vital and interesting to you who seek permanence, strength and sound economy in line construction. It will pay you, before buying any poles, to write for our booklet which describes in detail the exacting methods used in processing Weyerhaeuser Select Western Red Cedar poles.

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FIRST NATIONAL BANK BUILDING, SAINT PAUL, MINNESOTA

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Detroit Chicago St. Louis

Recent Rate Changes

Bronx Gas & Electric Company cannot be exempt from the provisions of the New York Public Service Commission's order directing the electric companies in New York City temporarily to reduce electric rates by 6 per cent for one year. A recent motion to annul the order in the case of the Bronx utility, proposed by Commissioner Van Namee, was denied by the commission by a vote of 4 to 1. This order is now pending in the courts and involves a saving of $142,500 a year to consumers of the Bronx company.

•

Dayton Power & Light Company has been authorized by the Ohio Public Utilities Commission to reduce its rates in several communities in southwestern Ohio. Under the new schedule residential rates will be 7 cents per kilowatt-hour for the first 30 a month; 6 cents for the next 50 and 3½ cents for all over 80.

•

Virginia Public Service Company has filed with the state Corporation Commission a new schedule of electric rates for residential service which will benefit 42,000 of the company's residential 59,000 customers and mean an aggregate reduction of $77,700 annually.

•

West Texas Utilities Company can prevent the construction of a municipal plant in San Angelo by reducing its electric rates to the amount it would cost the city to produce and distribute energy. R. Wilbur Brown, chairman of the citizens' advisory committee, has informed Henry P. Hunt, general counsel for the P.W.A. at Washington, that the city will withdraw its application for a loan of $624,450 and a grant of $217,000 if the utility will cut its rates.

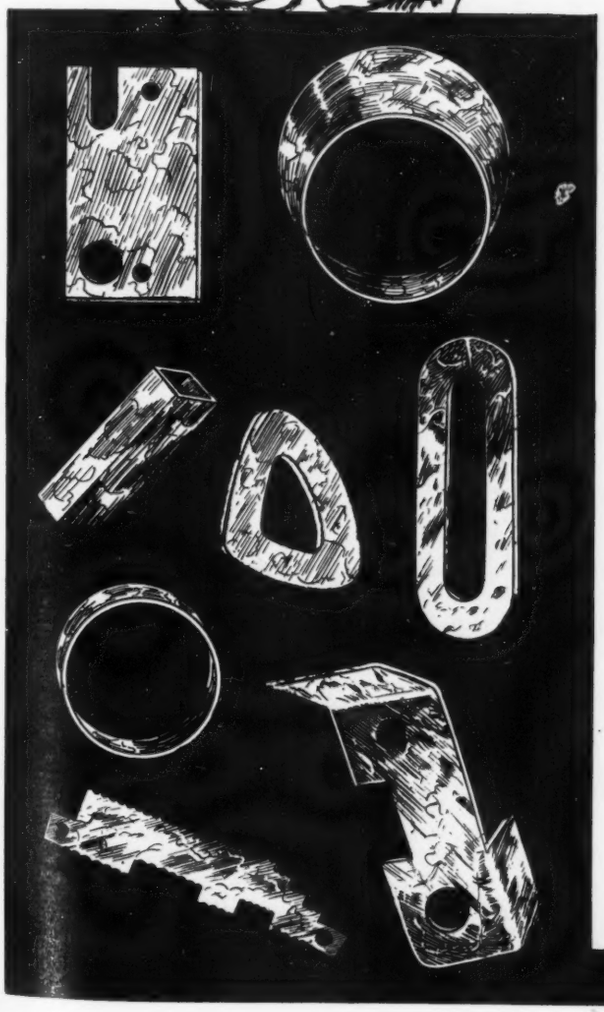
•

Montreal Light, Heat & Power, Consolidated, has recently announced its fifteenth voluntary reduction in electric rates for the city of Montreal. It represents a revenue loss of approximately 10 per cent. As a result of this reduction, which is one of 3 cents net per kilowatt-hour, the utility company's rates have been reduced from 12.75 cents per kilowatt-hour in 1908 to as low as $\frac{5}{10}$ of a cent per kilowatt-hour, which is the low rate in the 1934 schedule.

•

Public Service Electric & Gas Company was attacked on the depreciation front at the hearings held last week before the state Public Utilities Commission. In his valuation set-up the company's expert, J. A. Emery of Ford, Bacon & Davis, appraisal engineers, made a deduction of $21,678,154 for depreciation. John A. Matthews, of counsel for the petitioners, is seeking to establish that the deduction for depreciation should be much larger.

MICA by MACALLEN



THERE is no insulating material with all of the properties of Mica. Other materials serve for many insulating purposes, but there is no real substitute.

When substitutes are used the efficiency and trouble-proof operation of the electrical appliance is endangered. Under certain conditions of temperature, friction, moisture, load, etc. Mica —and only Mica—gives satisfactory long time service.

We are prepared to supply Mica in sheets, tubes, or accurately formed parts—in any quantity—promptly.

Our consulting engineers will gladly cooperate with you in solving any problem involving the use of Mica.

the MACALLEN CO.

16 MACALLEN ST. BOSTON

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BOOK REVIEWS

Electrical Measurements in Theory and Application

By Arthur Whitmore Smith. Published by McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 399 pages, illustrated. Price, $3.

Thermionic tubes have made a profound change in the technique of ordinary electrical measurements. Some of the ballistic galvanometer tests with d.c. for capacitance and inductance have yielded to a.c. measurement, many of which lend themselves to the niceties of tube characteristics and versatility. Professor Smith has recognized this in his third edition. He has also reshaped the presentation to exemplify the acceptance of the electron theory, where former works have dealt with circuit measurement almost exclusively on the galvanic concept.

In modernizing the content, the pedagogy and the vocabulary, the author has seen many points where earlier editions lacked in clarity. A flavoring of the historical academic methods has been preserved in the face of this modernization. Bringing the book up to date involved incorporation of the 1930 changes in the oersted and gauss. But in order to keep the development of the measurement topics in the order of relative difficulty of perception, the discussion of the absolute systems has been left for the closure.

For those who do not know the previous editions the Smith text treats the accepted methods for measuring resistance, current, electromotive force, power, magnetic flux and magnetomotive force, ferro-magnetism, capacitance and inductance. There is a chapter on electron tubes, for their own sake and as measuring tools.

•

Industrial Furnaces—Vol. 1

By W. Trinks. Published by John Wiley & Sons, Inc., 60 Broadway, Brooklyn, N. Y. 437 pages, illustrated. Price, $6.

Professor Trinks' two previous editions are hereby revised to bring research results, design and operating principles up to date. Research data have accumulated to shift design considerably away from empiricism toward rigidity; the book reflects this trend. Designers of furnace transformers and utility power sales engineers will find it a handbook of working data evolved from experience with many forms of design so presented as to be applicable to particular departures from these designs.

The multiplicity of factors affecting thermal performance of furnaces is so great that a book which shows the numerical scope of each of those factors is invaluable to the application engineer. Power sales engineers especially will welcome this revised edition because it will facilitate the refined comparison they must make where electric heating is proposed as superior to competitive fueled furnaces. The graphical data, tabulated constants and many numerical problems solved make the book uniquely comprehensive and specific as a working tool of analysis. This is true despite the author's caution that furnace design and analysis is still founded much upon intuitive experience and not yet reducible to formulized exactness.

•

Slim

By W. W. Haines, Little, Brown and Company, New York, N. Y. 414 pages, illustrated.

Attempts have been made to make novels using electrical men and electrical work as the core but few have been best sellers. This book is the life work and romance of a lineman. It is written in terms of a lineman's contacts, vocabulary and work and the development of Slim is a very interesting and realistic story. As a sample of dramatization of technical and mechanical work this book should be interesting to electrical men. As a story full of sharp contrasts and detailed experiences in the career of a lineman it is a splendid characterization and story. Slim was no saint, he loved life and saw life in the raw. It is a realistic study of a stratum of hard-boiled life and activity.

•

Government Ownership of Public Utilities

By James Goodwin Hodgson, compiler. Published by the H. W. Wilson Company, 958 University Avenue, New York, N. Y. 194 pages. Price, 60 cents.

"Electric" might well have been substituted for "Public" in the title of this book, which is specifically addressed to the resolution "That the government should own and operate all public utilities." The opening ten pages are devoted to the formulation of the brief on this debate, enumerating its many issues and following with a tabulation of the affirmative and negative items of argument. In devoting practically equal space and emphasis to all three aspects it strives to give a fair and impartial exposition, leaving the reader to be the judge and jury.

The case for private ownership is set up principally by extracts from papers by Samuel Ferguson, M. S. Sloan, Edward N. Hurley and W. J. Hagenah in ELECTRICAL WORLD, *Public Utilities Fortnightly*, Academy of Political Science *Proceedings* and *Public Service Magazine*. There is extensive bibliography, which helps make this volume of "The Reference Bookshelf" a fine basis for both sides of the never-finished debate. The brief is the only index.

Industrial Electronic Tubes

Published by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Six zincograph pamphlets totaling 217 pages, illustrated. Price, $2.25.

These pamphlets constitute six successive assignments in Westinghouse Extension Course No. 25 purposed to present the electron tube in a manner to be of aid in acquiring a fundamental understanding of the electron tube in industrial practice. The treatment is nonmathematical, starting with electronic phenomena and the mercury arc, passing to high-vacuum tubes and the grid-glow family, thence to photo-responsive electronic devices and cathode-ray tubes and ending with the specific technique of a variety of applications. Throughout the pages there is a purposefulness to all the fundamental material introduced about electronic phenomena and the circuits built around them—the purpose is to show how these physical properties can be put to practical use in industrial objective of manipulation and control.

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Courants de Court-Circuit

By Jean Fallou. Published by Librairie J-B Bailliere et Fils, 19, Rue Hautefeuille, Paris, France. 180 pages, 55 illustrations. Price, 27 francs.

Based on Fortescue's theorem that any group of vectors can be replaced by an equal number of systems of symmetrical polyphase vectors, mathematical reasoning leads to the development of equations for various conditions of short circuits and grounds. The second part of the book discusses the equivalent impedances of rotating machinery and other elements to be used in the computations, the third deals with methods for limiting the magnitudes of short circuits. To the transmission engineer who knows how to translate theory into practice this treatment of the subject should prove valuable.

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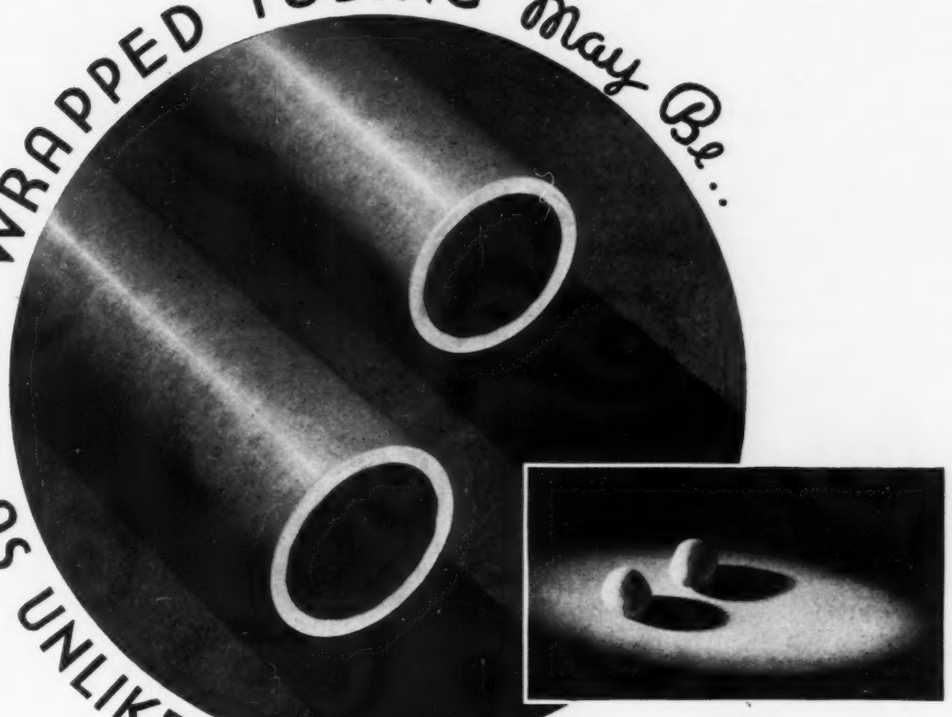
Elektrische Oefen, Lieferung 1

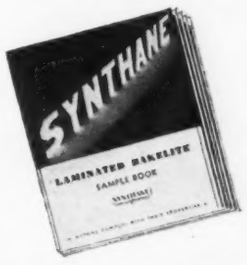
(Electric Furnaces, Section 1)

By Adolf Bräuer and Josef Reitstötter. Published by Akademische Verlagsgesellschaft m.b.H., Leipzig, Cl. 176 pages. Price, 28 reichsmark.

This is the first section of a survey of German patents relating to electric furnaces. The entire volume on this subject is to consist of six sections, to be published serially. The one now issued comprises three parts. The first, of 64 pages, is a review of the development of various types and features with references to specific patents. The next part lists German patents, with claims Nos. 17,736 to 231,807. The introduction indicates that ultimately numbers up to 540,969 are to be covered. The final sixteen pages refer to American patents. These are listed by number only, without descriptions, arranged according to the U. S. Patent Office classification.

WRAPPED TUBING May Be . . AS UNLIKE AS TWO PEAS



Superficially two peas look alike. But a closer scrutiny, under a lens, will reveal rugged individualism most unbecoming for twins. So it is with laminated bakelite tubing. At first glance you might conceivably miss the distinctions which make Synthane Wrapped Tubing worth many times more at no extra cost. • • • Synthane Wrapped Tubing is processed from the finest base materials procurable. Every step—impregnation, drying, wrapping, curing, grinding and polishing—is controlled to produce tubes precisely the equal of each other, grade for grade and size for size. Frequent and rigid inspections insure absolute uniformity in physical properties, machining qualities, structural and electrical characteristics.

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MEN OF THE INDUSTRY

W. H. Burr New President Iron and Steel Association

Walter H. Burr, for the past thirteen years connected with the Lukens Steel Company, Coatesville, Pa., has been elected president of the association of Iron and Steel Electrical Engineers for the year 1934-35. Graduated from Rose Polytechnic Institute, Terre Haute, Ind., in electrical engineering in 1905, Mr. Burr entered the employ of the Westinghouse Electric & Manufacturing Company as an apprentice at the East Pittsburgh, Pa., works. In 1906 he was transferred to the service department of the Philadelphia office, where he remained eleven years, during which time he acted as test engineer, construction engineer, assistant district engineer and was engaged on construction work in connection with a number of water and steam power plants and the electrification of many steel mills and railroads in the East.

W. H. Burr

He left Westinghouse and became associated with the Alan Wood Steel Company, Conshohocken, Pa., as assistant electrical engineer in 1917, and remained in this capacity four years. In 1921 he went to Coatesville as superintendent of the electrical department of Lukens, and in 1932 was made superintendent of electrical and mechanical departments.

He has been a member of the Association of Iron and Steel Electrical Engineers for seventeen years, having served as chairman of the Philadelphia section twice. He has been national chairman of the developments committee for the past seven years and has taken an active part in affairs of the association.

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▶ARTHUR P. GOOD, who last year was appointed assistant superintendent, meter department, Commonwealth Edison Company, Chicago, was appointed superintendent October 1 when J. H. PERRY retired. Mr. Perry, well known in the meter engineering field through long identification with local and national meter committees, had completed 42 years with the meter department of the company at the time of his retirement. Mr. Good's previous position as assistant superintendent is now occupied by CURTIS W. BOOTH, formerly head of the inspection division of the department.

▶JOHN C. LINCOLN, chairman of the board of the Lincoln Electric Company, Cleveland, has been awarded the Samuel Wylie Miller medal by the American Welding Society in recognition of his great contributions to the advancement of the science of electric fusion welding. One of the early pioneers of arc welding, Mr. Lincoln has devoted most of his life to research and development of the electric arc as an industrial tool. With the Elliott-Lincoln Electric Company, one of the pioneer manufacturers of electric motors, as a nucleus, he formed the present Lincoln Electric Company in 1896.

•

New England Power Makes Executive Appointments

Thomas G. Dignan, secretary of the New England Power Association, Boston, will become vice-president and general manager of the Worcester Electric Light Company October 15 and also district manager of the central district group of operating companies in the New England Power system. He was born in Wakefield, Mass., in 1899 and in 1927 entered the legal department of the association at Boston, soon becoming assistant general counsel. Later he spent eighteen months as operating manager of the Lowell Electric Light Corporation, returning to Boston in 1932 to the secretaryship of the parent organization.

T. G. Dignan

Leon E. Seekins, vice-president and general manager of the Worcester Electric Light Company since 1929, has been appointed vice-president and general manager of the Lowell Electric Light Corporation. He will also become district manager of the northeastern group of New England Power Association properties. Mr. Seekins is a native of St. Albans, Me. He entered the employ of the Lowell company in 1913 as a meter tester, subsequently serving as foreman of the meter department, power sales engineer and assistant to the manager. For a short time he was manager of the Cape Breton (N. S.) Electric Company, with headquarters at Sydney.

L. E. Seekins

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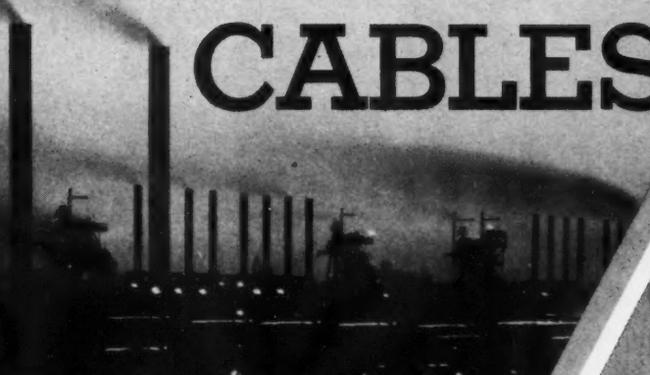
▶G. W. SWIFT, formerly connected with the Western Public Service Company in Nebraska, has been appointed vice-president of the Norfolk division of the Virginia Electric & Power Company, with headquarters in Norfolk. Both these companies are units of the Stone & Webster system.

▶HAROLD SMITH has been elected vice-president of the Westinghouse Electric International Company. Mr. Smith joined the Westinghouse organization in 1919 as a member of the legal department of the Westinghouse Electric & Manufacturing Company. His new duties will be in addition to those of his position as vice-president of the Westinghouse Electric & Manufacturing Company. His headquarters are in New York.

▶IVAN A. PATTEN has been appointed general superintendent of the electrical department of the Lynn (Mass.) Gas & Electric Company, succeeding James A. Cook, whose promotion to the general managership was announced in ELEC-

VARNISHED CAMBRIC CABLES



All Standard Types for **STATION, INDUSTRIAL** and other use . . . .

BRAIDED • LEAD COVERED ARMORED

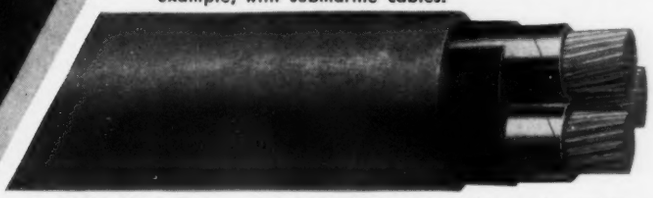
Backed by the responsibility of General Cable engineering, manufacturing facilities and quality control.

Switchboard Wire — Has unusual flame-resisting properties and can be bent at right angles without injury. For hinged panel use, stranded conductors are furnished.

Brush Holder and Apparatus Cable — With rope strand conductor the design throughout is of an exceptionally flexible construction, so necessary to the proper operation of these cables.

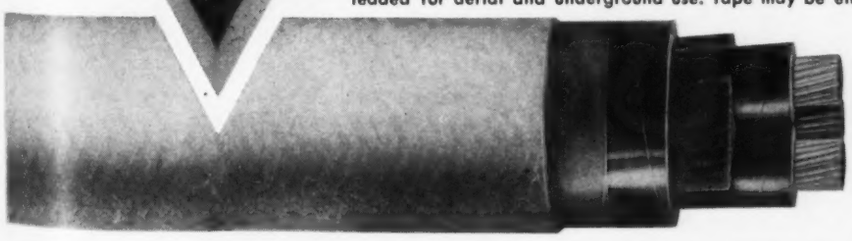
Annular Conductors — Are extensively used in many interior locations for handling large currents efficiently.

Steel Wire Armor — Applied to varnished cambric insulated cables used in installations where mechanical injury is a hazard, as, for example, with submarine cables.



Lead Sheath — For power transmission and distribution in underground conduit or other locations where deteriorating influences exist.

Interlocking Steel Tape Armor — Affords complete mechanical protection with exceptional flexibility. Used for station cables leaded and non-leaded, also leaded for aerial and underground use. Tape may be either zinc or steel.



Braided — Furnished with weather-proof, flame-resisting or asbestos braids. Admirably suited for central station and many industrial applications.

GENERAL CABLE CORPORATION

TRICAL WORLD September 15, page 80. Mr. Patten is well known in both electric railway and power circles in eastern New England. He entered the Lynn company's service in 1911 in the underground construction department, becoming superintendent of distribution in 1922. In 1930 he was appointed assistant superintendent of the electrical department. Mr. Patten was chairman of the Electric Lines Club of New England for two years and headed the overhead systems committee of the New England division, N.E.L.A., for a year.

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Westinghouse Supply Names New Vice-Presidents

Bonnell W. Clark has been appointed vice-president and general manager of the Westinghouse Electric Supply Company and H. N. Gansman and R. J. Holtermann vice-presidents. Mr. Clark joined the Westinghouse Commercial Investment Company as a special agent in 1925, later becoming assistant to the vice-president and in 1927 receiving the appointment of general manager. When the company name was changed to the Westinghouse Electric Supply Company Mr. Clark retained his position as general manager. His previous connections have been with the Robertson Electric Company (now Robertson-Cataract Electric Company), the Gould Storage Battery Company and the Gillespie Eden Corporation.

Mr. Gansman has been connected with the Westinghouse company during his entire business career and in 1920, when Westinghouse decided to build up a distributing chain, he was given the

B. W. Clark

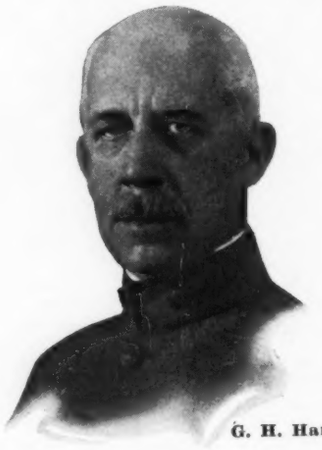
management of the first institution it acquired. In 1931 he became general sales manager of the Westinghouse Electric Supply Company, with headquarters in New York.

Mr. Holtermann was identified with the Fobes Supply Company when it was acquired by Westinghouse interests in 1923. In 1932 he was made district manager for the Westinghouse Electric Supply Company's entire operations west of the Rocky Mountains.

OBITUARY

Major-Gen. G. H. Harries

Major-Gen. George H. Harries, public utility executive, financier and journalist, died at Waverly, Md., September 28, of pneumonia. His age was 74. A man of wide and varied experience, broad views and a comprehensive knowledge of men and affairs, General Harries had long been a factor in both the electric light



G. H. Harries

and power and the electric railway industries.

Born at Haverfordwest, South Wales, in 1860, General Harries came to America at an early age, settling in the West. While a young man he went to Canada, and subsequently returning to this country he obtained a position in the Government Printing Office in Washington. During the period 1892-97 he was successively a printer, a reporter and the associate editor on the Washington *Evening Star*. He became an expert on public service work and resigned from his editorial position to become president of the Metropolitan Street Railway in Washington in 1895. One year later he was appointed secretary of the Washington Board of Trade, later serving as president of that body. With the formation of the Washington Railway & Electric Company in 1900 he was selected for the vice-presidency and continued in that office until the fall of 1911. He then was elected vice-president of H. M. Byllesby & Company and in that capacity went from city to city shaping up the policies of public utilities in more than one hundred cities and towns.

In the meantime General Harries was also pursuing a military career. When the United States entered the World War General Harries again got into service. In France General Pershing, personally familiar with his capacity as an organizer, placed him in command of Base Section No. 5, A.E.F., with headquarters at Brest. The manner in which General Harries handled this task makes it one of the notable achievements of the American army in France.

General Harries was a fellow of the American Institute of Electrical Engineers and president of the American Electric Railway Association in 1912-13, the Association of Edison Illuminating Companies in 1911-12 and the Illuminating Engineering Society in 1920-21. He was a member of the American Society of Mechanical Engineers, the old National Electric Light Association, American Gas Institute and other engineering societies.

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Dr. Calvin W. Rice

Dr. Calvin W. Rice, executive secretary of the American Society of Mechanical Engineers since 1906, died October 2 in New York of a cerebral hemorrhage. He was 65 years of age. During an exceptionally active life Dr. Rice had traveled extensively and had received many honors both in this country and abroad. After fifteen years of varied experience in electrical, steam and hydraulic engineering work Dr. Rice became permanent secretary of the A.S.M.E. in 1906 and since that time he had been the guiding force of the organization.

At the society's 50th anniversary, in 1930, Dr. Rice outlined a new philosophy for engineers, in which he discussed not so much the marvels of engineering mechanics and their ingenuity, but the social implications of scientific advance and its consequent relation to human life. The time will come, Dr. Rice said then, when engineers "will have developed a new sense of responsibility to society, and engineering organizations

C. W. Rice

will undertake the solution of innumerable problems that have been the unfortunate and often tragic concomitants of technological progress . . . It is life itself that is important, and not the fascinating details of its technique."

After graduation from the Massachusetts Institute of Technology in 1890, Dr. Rice entered the employ of the Thomson-Houston Electric Company at Lynn, Mass., as an assistant engineer. In 1893 he became electrical engineer for the

General Electric Company, leaving to join the Anaconda Copper Mining Company and the Silver Lakes Mines Company in Colorado, where he served as electrical superintendent. Returning to New York, he held various engineering positions with the Kings County Electric Light & Power Company, Brooklyn; the Consolidated Telegraph & Electric Subway Company, which owned and operated the high-tension conduits in New York, and the New York Edison Company. Since 1903 he had been a vice-president and sales manager of the Nernst Lamp Company and a consulting engineer for the General Electric Company.

Dr. Rice held membership in many scientific organizations all over the world. He was a member of the American Committee of the World Power Conference, a fellow of the American Association for the Advancement of Science and a fellow and past-vice-president of the American Institute of Electrical Engineers.

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▶ FRITZ PHILIP LINDH, vice-president of Bonbright & Company, Inc., investment bankers, died suddenly September 28 in his office in New York as the result of a heart attack. He was 43 years old. Mr. Lindh was graduated from the United States Military Academy at West Point in 1914 and pursued a military career from that year until 1920, when he resigned to enter business. He was elected vice-president of Bonbright & Company last year.

▶ WILLIAM P. WHITE, manager of the customer division of the central station department of the General Electric Company, died suddenly September 22 at his home in Schenectady. He had been associated with the General Electric Company for the past 28 years. Mr. White was active in the Electric Power Club, which later became the National Electrical Manufacturers' Association. He was at one time chairman of the Pittsfield section of the American Institute of Electrical Engineers and was actively engaged in committee work for the old National Electric Light Association. He was 49 years of age.

▶ ARTHUR W. DAWSON, manager of the Michigan Northern Power Company, Sault Ste. Marie, died recently. Born in Sault Ste. Marie in 1877, Mr. Dawson obtained his early experience with the Bell Telephone Company and subsequently engaged in power house work with the Canadian government. In 1902 he became chief operator for the Michigan Lake Superior Power Company. One year later he was named superintendent, taking charge a few years later of the electrical installation and operation of a station of the Michigan Northern Power Company, of which he eventually became manager.

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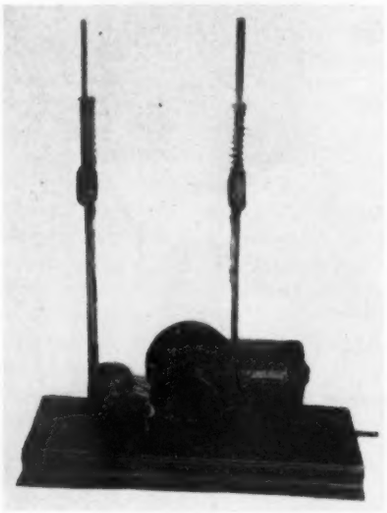
NEW EQUIPMENT

Electro-Shift Power Unit

"Tiffin Electro-Shift" power unit, controlled by remote, constant-pressure, up-and-down buttons, has been announced by the Quincy Elevator Gate Company, Tiffin, Ohio. It is used to shift mechanically the shipper rope of a cable-controlled elevator with results similar to that of a two-button-controlled modern elevator. A reversible motor is wound for special duty so that it will stall on the line without injury. The constant pressure type control eliminates the need of travel limit switches, except for the automatic power drive, which always brings the shipper rope to neutral or stop position whenever a button is released. The Tiffin Electro-Shift may be used to control hydraulic or electric elevators and will also work properly where mechanical brakes are used, it is claimed.



Quincy Elevator Gate

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Arc-Welding Electrode

Designated as type W-23, a heavily coated arc-welding electrode for the economical production of high-speed, high-quality welds in the flat position has been announced by the General Electric Company. They are suitable for either manual or automatic arc welding and will produce equally good results on either alternating or direct current, it is claimed.

Welds made more than meet the requirements for Class I, A.S.M.E. Boiler Code and E-10 A.W.S. tentative filler metal specifications. They have been approved by the American Bureau of Shipping for Class I, E-10 A.W.S. specifications, welding in the construction of hulls and machinery subject to classification by the bureau.

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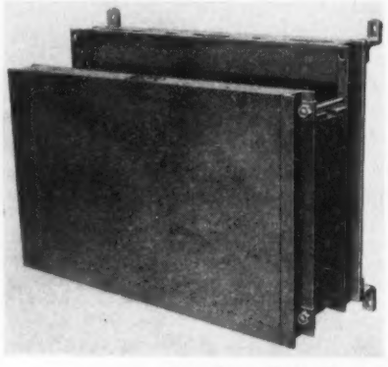
AMINCO LABORATORY STIRRER, which has a more powerful and more easily adjustable stirring motor than has been available heretofore, has been announced by the American Instrument Company, Washington, D. C. A rheostat housed in the mounting bracket gives continuous speed control. Three shafts are brought out at different speed ranges between 125 and 11,000 r.p.m. By means of a special mounting, the motor may be turned instantly so that any shaft is either vertical or at any angle to the horizontal.

•

Three-Phase, Air-Cooled, General-Purpose Transformers

A complete line of three-phase, air-cooled, general-purpose transformers has been announced by the American Transformer Company, Newark, N. J. Type CFT three-phase units are made in sizes from 0.5 to 15 kva., 60 cycles, and are of the weatherproof, self-cooled type which may be installed either indoors or outside without the necessity of a fireproof vault or inclosure. They are provided with castings at top and bottom to inclose completely the coils and are compound filled to render them suitable for outdoor use.

Units in sizes from 20 to 150 kva., 60 cycles, are furnished in type WFT ventilated mountings suitable for indoor service only. Both are double-wound transformers for supplying 120, 240 or 480-volt circuits from a three-phase 120, 240, 600 or 2,400-volt source of supply. Standard Y-connected booster autotransformers with ratings of 208 volts primary to 220 or 230 volts secondary are also available in the same type of mountings. All types listed can be furnished for 25, 50 or 60-cycle service and in sizes from 0.5 to 150 kva. output.



American Transformer

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Compact Circuit Breaker Interrupts 20,000 Amp.

Low-voltage "Deïon" breaker AB-20, with interrupting capacity of 20,000 amp., has been announced by the Westinghouse Electric & Manufacturing Company. It is totally inclosed and available in all ratings from 50 to 600 amp., complete with standard tripping accessories and motor mechanism. Doubling the interrupting capacity of the standard AB breaker was accomplished by a complete redesign of the contact structure and major modifications in the "Deïon" chambers and operating mechanism.

Westinghouse

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Mechanism Box Eliminated From Oil Circuit Breakers

The General Electric FHKO-339 line of outdoor oil-blast circuit breakers has been extended to include voltage ratings above 24.5 kv., the principal improvement over the older FHKO-239 design being the elimination of the removable mechanism box and cover. The operating mechanism frame is welded to the breaker dome, and the only openings in the dome are those for the two bushings, a hand-hole with bolted cover allowing access to the crank and some small plug holes for inserting pins in the linkage.

The 46-kv. FHKO-330 circuit breakers are equipped with "L" type, heavy oil-filled bushings. Higher voltage breakers have "F" type bushings filled with light oil, identical with those used on the replaced FHKO-239 line. Comparing 69-kv. circuit breakers of the new and the superseded designs, it is found that the dome unit of the new breaker weighs

690 lb. less than the old, has 30 ft. less of welding and 17 ft. less of weatherproof gaskets.

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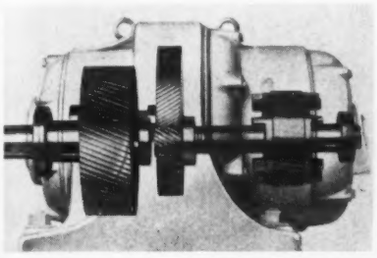
Geared Motor With Speed Range

Any speed from 2 to 10,000 r.p.m. is available in the range of "Syncrogear" motors announced by U. S. Electrical Manufacturing Company, Los Angeles, to convert high motor speed into low



U. S. Electrical

speed with enhanced torque. It is a self-contained motor with single base, the structure designed to withstand the unusual torque strains resulting from large speed reduction. The highest speed gears are only partially immersed to avoid foaming and eddy power loss. Design is splash-proof and weatherproof, but gear assembly is readily accessible for ratio change on the job. Take-off shaft is in line with motor shaft for all double reductions.

•

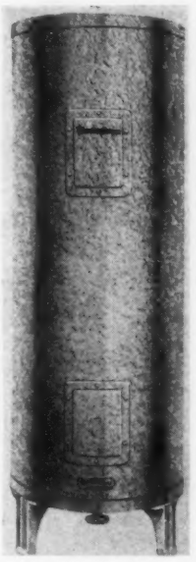
Knocker-Lite Keyhole Finder

Knocker-Lite Company, Cleveland, Ohio, has announced a new Knocker-Lite keyhole finder which has a miniature lamp which throws a beam of light downward whenever the knocker is raised.

Knocker-Lite

Despite its small size, the tiny lamp provides ample light to illuminate the keyhole, so that the key may be inserted with ease. Two small batteries light the lamp.

Automatic Water Heater



Westinghouse

An automatic electric water heater which is highly efficient because of a new insulating material has been announced by the Westinghouse Electric & Manufacturing Company. It is of 30-gal. capacity and is especially suitable for domestic use. Some of the outstanding features include a new type thermostat for adjustable automatic temperature control, hermetically sealed "Corox" looped hairpin heating element, with provisions for the addition of another element for larger capacities.

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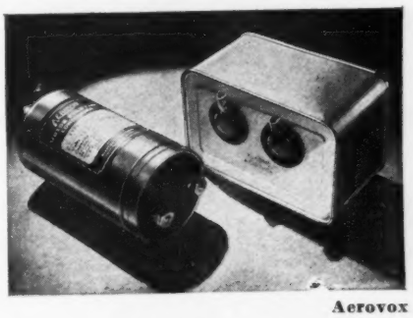
Condenser Suitable for Condenser-Start Motors

Wide variety of both electrolytic and oil-filled condensers for condenser-start motors is announced by the Aerovox Corporation, Brooklyn, N. Y., obtainable



Aerovox

in round rubber-insulated or standard cans and in rectangular cans with or without insulating jackets. Oil-filled units are intended for condenser-transformer motors and power-factor correction. Critical balance between section and container assures just the right volume of oil for proper oil circulation and cooling action as section expands under load and contracts when at rest.

•

The new Fusetron by Bussman Manufacturing Company, St. Louis, is for motors of 10 amp. or less, not to blow on starting currents, but to give sure protection against overloads. Long-continued light overloads actuate the thermal cutout, a spring released by melting of a soldered joint pulling out the end of the fuse strip. Nevertheless, the Fusetron holds on short-time heavy starting current.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Radio for Tractor Control tells how International Harvester Company (606 South Michigan Avenue, Chicago) operates the tractor at A Century of Progress and what is seen for its future practicality as a farm aid.

Recommended Standards of Illumination—No minima are now tabulated in this new booklet, published by Incandescent Lamp Department of General Electric Company, Nela Park, Cleveland, Ohio. New appropriate levels are indicated for store, office, mill, school and outdoor areas to incorporate what the "science of seeing" dictates.

"Shield Arc" Welder Specification, Bulletin No. 303, gives the general specifications for belted and direct-driven units in 300-, 400- and 600-amp. ratings. Weights and dimensions are recorded. Lincoln Electric Company, Cleveland.

Pressure Relays and Telemeters are included in the "Pressure Recording Instruments" covered by 8-page bulletin 834 of the Esterline-Angus Company of Indianapolis. Mechanisms, applications and operating suggestions are detailed.

Details of All Controlling and Distributing Apparatus of Bull Dog Electric Products Company (Detroit) are presented in a new 64-page catalog No. 34, covering safety switches, meter service switches, "Fusenters," lighting panels, etc., along with the new Bustribution system.

Temperature Limit Control for Furnace Roofs is Application Bulletin 53-116 of Leeds & Northrup Company (4901 Stenton Avenue, Philadelphia) which shows how to stop overheating and excessive maintenance costs of furnace roofs by instrumentation.

Buss Fuse Catalogue E of Bussman Manufacturing Company, St. Louis, lists the new "Fusetrons" along with blowing-time data and dimensions for Super-lag renewables, one-time fuses and accessories (21 pages).

High Tensile Steels for Light-Weight Construction enumerates the properties, processing technique and application advantages of corrosion-resisting, manganese and silicon steels sold as Cor-ten, Man-ten and Sil-ten by United States Steel Corporation Subsidiaries for light-weight construction of rolling stock and similar uses. Frick Building, Pittsburgh, Pa.

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IF YOU'VE ever been called on by a McGraw-Hill circulation man, you know he's not an ordinary solicitor. He isn't "working his way through college"—he's *been* through. His job is more than just to sell magazine subscriptions. It's to see that the men in your company who can profit most from McGraw-Hill publications are reading them—and reading the right ones.

There may be thousands in your organization, yet the McGraw-Hill man wants to see only that handful of "key men" who need these magazines. He wants your power plant chief to keep alert by reading *Power,* your design engineers to keep posted on the newest ideas through *Product Engineering.* He wants your department heads, superintendents and engineers, your responsible officials in all branches, to read the particular McGraw-Hill publications intended to help them in their jobs. When your men change from one department to another, when new men join your staff, he wants to help fit McGraw-Hill's editorial service to each man's individual job.

You may be doing a marvelous job of welfare work for your employees, yet overlooking an opportunity for letting your key men make themselves more useful and more efficient in their jobs. Yours may be a "non-concession" plant without your knowing it. It will pay you to inquire whether the McGraw-Hill man is privileged to carry on his valuable service in your organization. If he isn't,—please open the gates to him! You'll be opening them to new ideas, new opportunities and greater alertness in your personnel. We shall be pleased to tell you about various helpful plans actually used in a great many different companies.

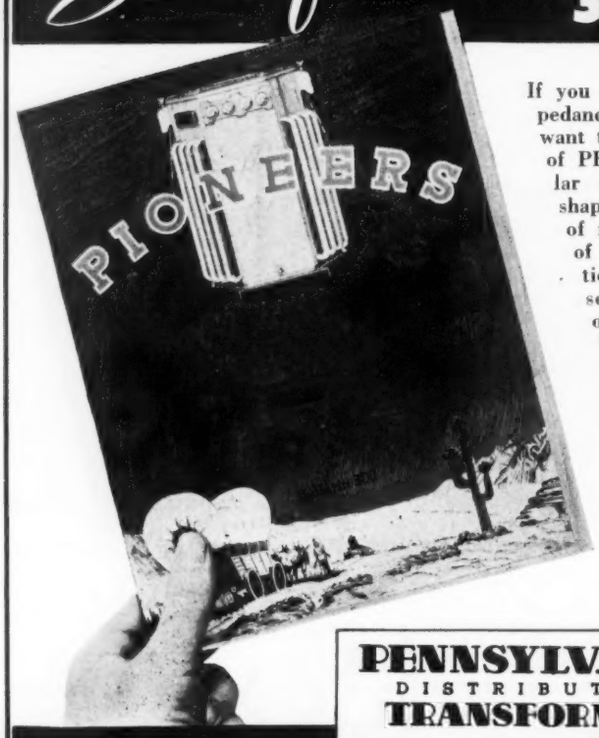
WARNING!

Every McGraw-Hill representative carries an identification card. Before giving any subscription orders, please ask him to show his credentials. Or, in subscribing by mail, do not send money to anyone but the McGraw-Hill Publishing Co., 330 West 42nd Street, New York City.

PUBLISHING COMPANY, Inc.

Electrical World
Electronics
Engineering and Mining Journal
Engineering News-Record
Factory Management and Maintenance
Food Industries
Metal and Mineral Markets
Power
Product Engineering
Radio Retailing
Textile World
Transit Journal

Send for BULLETIN 300



If you are considering low-impedance transformers, you will want to know the advantages of PENNSYLVANIA'S circular coils over any other shape. Yet this is only one of many exclusive features of Pennsylvania Distribution Transformers, described and illustrated in our new Bulletin 300. Your copy is ready on request.

PENNSYLVANIA TRANSFORMER CO.
1629 Island Ave., N.S.
Pittsburgh, Pa.

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TRANSFORMERS

P&H PROCESS Poles
Field Tests Prove their Long Life

P&H
"Still in the Lead"

PAGE AND HILL CO.
MINNEAPOLIS, MINN.
CEDAR IS THE NATURAL POLE WOOD

Personnel Changes

▶OTIS A. GLAZEBROOK, JR., of G. M-P Murphy & Company, New York, has been elected a director of the Bridgeport (Conn.) Brass Company.

▶ HERBERT A. MAY, formerly assistant to the president of the Westinghouse Electric & Manufacturing Company, has been appointed vice-president of the Safety Car Heating & Lighting Company. He will make his headquarters in Pittsburgh.

▶ E. E. TURKINGTON has been appointed chairman of the National Fire Protection Association's new committee on static electricity. The committee will prepare recommendations on methods of eliminating or controlling the hazard of ignition by static electricity. Mr. Turkington is a member of two American Standards Association sectional committees.

▶ THOMAS E. CHADWICK, since 1931 a field representative of Kelvinator Corporation, has joined the Graybar Electric Company, Inc., in a sales executive capacity. He will be general merchandise manager for Cleveland, Akron and Toledo, in charge of the merchandising of Kelvinator products and all other electrical appliances sold by Graybar in those territories. Mr. Chadwick has been prominent in specialty sales work for almost 20 years.

▶ A. D. WALTER has joined the staff of the Peerless Electric Company, Warren, Ohio. Mr. Walter helped to organize the Ohio Electric & Manufacturing Company in Cleveland and for more than fifteen years has specialized in the design and construction of small motors. His broad experience in the small motor field has included the application of special split-phase and capacitor type motors for the oil burner industry and air-conditioning systems.

▶ JOHN M. SALLING, service engineer in the Chicago office of Underwriters' Laboratories, has been transferred to the New York office to continue the work handled by the late Chester J. Peacock. Mr. Salling is well acquainted with the various phases of the Laboratories' work in the east and in the New York office in particular. For seven years he was a member of the electrical department staff, and as an assistant electrical engineer he has had experience in all phases of the department's activities. This work included not only the examination, testing and preparation of reports on devices, but industry conference deliberations and the subsequent preparation and promulgation of the department's published standards. In the fall of 1929 he was transferred to the Chicago office as a

service engineer in the label service department and has continuously served in that capacity.

▶ C. H. BISSELL of Crouse-Hinds Company has been appointed a member of the codes and standards committee of the National Electrical Manufacturers Association by the board of governors. He is succeeding W. H. Harrington.

▶ C. R. BROGAN, for the past six months in charge of the Atlanta, Ga., branch of Kelvinator Corporation, has been appointed district manager, with supervision over Kelvinator's activities in North Carolina, South Carolina and Virginia. He assumes the position left vacant since the death of J. K. MacCarthy in August. GEORGE BRYANT, a sales executive for many years in the refrigeration industry and since March a special sales representative working with Mr. Brogan, will take over the Atlanta branch managership.

▶ E. D. SPICER has been appointed manager of the General Electric Company's Schenectady Works to succeed Burton L. Delack, who, because of impaired health, had asked to be relieved of the responsibilities of the position. Mr. Spicer has been identified with the General Electric organization since 1924. Mr. Delack spent his entire business life with the General Electric Company, having joined the company as a student engineer in 1903.

▶ W. R. WINANS, for nearly ten years in charge of the public utilities division of the Frigidaire Corporation, is now a member of the executive sales staff of Electromaster, Inc., of Detroit. He is opening a New York office for the company and from that point will contact the larger power companies in various parts of the country. Mr. Winans was at one time in the utility field. Prior to his connection with Frigidaire he was with the Cities Service Company, being primarily responsible for its original program in promoting electrical refrigeration.

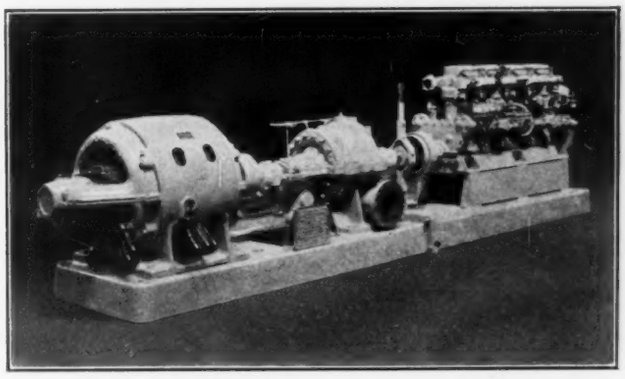
▶ WILLIAM G. BESLER has been elected chairman of the board of directors of the Gamewell Company, Newton, Mass., and WILLIAM GELLATLY and MATTHEW POROSKY have been elected vice-presidents. Mr. Porosky is chairman of the signaling apparatus section of the National Electrical Manufacturers' Association and a member of its board of governors. Mr. Gellatly's headquarters will be in New York City. Warren J. Miller was re-elected a vice-president and Vincent C. Stanley was re-elected president of the company. ALTON R. WELTON has been elected president of the affiliated Holtzer-Cabot Electric Company, Boston, Mass., and W. H. ELDRIDGE has been elected vice-president of that organization.

PREPARE FOR POWER INTERRUPTION

Equip with quick starting engines of known reliability, and built in finer dynamic balance, for the higher speeds required for direct connection to emergency pumps or generators.

Sterling High Duty — Internal Combustion Engines

12 to 565 B.H.P. Gas or gasoline



At Iron River, Michigan, 10 x 8" 3 stage Allis-Chalmers dual drive pump driven by 150 H.P. Dolphin 8 cyl. Sterling engine rating 1500 G.P.M., 269 ft. head 1175 R.P.M.

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NOW EASIER AND LESS COSTLY TO PULL SLACK IN WORKING CABLES . . .

Can be attached and removed without cutting cables. Strong hooks which are easily fastened and unfastened eliminate trouble of lacing grip with rawhide. Designed so that few hooking operations are necessary to connect the two sides of grip. Pull is evenly distributed over entire grip, insuring long life and economical use.

Write for descriptive bulletin.

Single Eye Cable Grips—Hard Wire, for attaching pulling line to the end of a cable.

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Double Eye Luffing Cable Grips, for pulling slack or removing old cable.

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Used for years on telephone, telegraph, railroad and lighting company distribution lines . . . . . a dependable source of supply for uniform, well-designed transparent glass insulators.

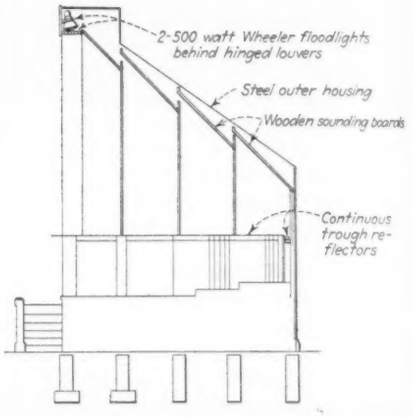
WHITALL TATUM COMPANY

Glass Manufacturers Since 1836

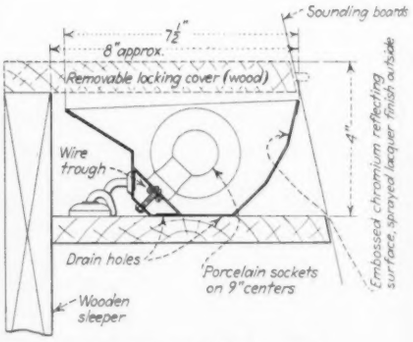
225 Varick Street - NEW YORK

Lighting Aids Musicians, Audience

Improved lighting which serves not only the orchestra but members of the audience even 300 ft. from the new acoustic shell on the Charles River Esplanade, Boston, features the installation for this famous series of outdoor symphony concerts designed along new lines this year by Harold


2-500 watt Wheeler floodlights behind hinged louvers
Steel outer housing
Wooden sounding boards
Continuous trough reflectors

Half-section of shell showing reflector and floodlight locations



Detail of light trough

Field Kellogg, consulting architect of the Metropolitan District Commission. The shell accommodates about 55 players and is semi-hexagonal in shape, 50 ft. 8 in. wide at the front, 17 ft. wide at the rear, 20 ft. deep in the center and 24 ft. from the podium to the top of the arch. With the exception of two 500-watt floodlamps mounted over the conductor's platform in the ceiling for concentrated illumination upon the baton wielder and supplementary lighting at the outer and central portions of the orchestra positions the indirect system of lighting prevails throughout.

The outer housing of the shell is of steel and the inner surface is provided with wooden sounding boards. The main lighting service is furnished by

88 100-watt lamps mounted on approximately 9-in. centers in a continuous chromium-painted trough reflector about 4 ft. 6 in. above the rear floor and entirely concealed from the audience. The equipment was built by the Wheeler Reflector Company, Boston, and as all the light is thrown upward from the cove upon the sounding boards and gives the musician from 5 to 15 ft.-candles, according to their location, besides putting them in silhouette, the effect from the audience is unusually pleasing. The mechanics of the illumination is obscured by the indirect lighting, adding to the enjoyment of the programs. Newspaper print can be read with ease over 300 ft. from the stage on account of the diffusion obtained from the sounding board structure.

•

Helping the Trade Cash In on Better Lighting

Training of local equipment resale outlets throughout the country is a task that Westinghouse Electric & Manufacturing Company is undertaking, to capitalize on the new-approach basis of selling better lighting. This company feels that there are many salesmen among distributors, jobbers, dealers, contractor-engineer and home-furnishing stores who will not attend lighting-sales training schools. They must be trained in their own organizations.

In conducting this task the resale outlets are approached personally and, by means of an album of very effective single-idea photos, supplemented by specific facts from the science-of-seeing, are impressed with the new method of selling that will bring business. This album, which is the basis of interesting resale outlets, is also usable by the latter in selling their own prospects.

With this album and supplementary comments, the resale-outlet salesman is shown how he can interest prospects in better lighting. This done, he can show his prospects how easy it is to have modern lighting.

For a moderate payment, the resale outlet is furnished with such selling tools as a light-meter, on-the-spot demonstrator and the picture album with a booklet of comments supplementing the captions to guide conversation.

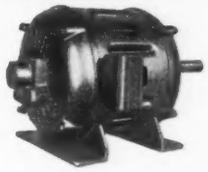
A lighting layout is recommended to the prospect and he is told that if it is installed as suggested, he will be given a certificate stating that it is "Certified Westinghouse Illumination." At this point the prospect is usually willing to witness a demonstration of the benefits from improved lighting, which usually leads to the installation.

A Wagner motor

for every industrial requirement

Singlephase or polyphase, squirrel-cage or slip-ring or synchronous, sleeve-bearing or ball-bearing, open or totally-enclosed, single-speed or multi-speed, horizontal or vertical—whatever the type or size of motor required, there's a Wagner motor ideally suited for the job.

The wide range of types and ratings of motors manufactured by Wagner is an assurance to motor buyers and users that Wagner recommendations are made without prejudice, that at no time will the wrong type of motor be supplied, and that entire plants can be correctly motored without delay and unreasonable expense.



SQUIRREL-CAGE MOTORS

Type RP

Wagner builds seven types of squirrel-cage motors, to meet different torque, current, and slip considerations. 1/10 to 400 horsepower. Described in Bulletin 174, Parts 3 and 4.

TOTALLY-ENCLOSED FAN-COOLED MOTORS

Type CP

Each Wagner Type CP motor is a one-time investment, with no subsequent upkeep other than that of periodic greasing—because the motor is **totally enclosed** against the entrance of dust, filings, fumes, moisture and other troublesome matter. Built in 1½ to 60 horsepower. Described in Bulletin 174, Part 5.

MULTI-SPEED MOTORS

Types MRP and MCP

The open and totally-enclosed fan-cooled motors described above are also available in 2, 3, and 4 speeds, as constant-torque, constant-horsepower, and variable-torque motors. ½ to 125 horsepower. Described in Bulletin 174, Part 5C.

GEAR MOTORS

Wagner motors are available with gear units—in a wide variety of output speeds.

SLIP-RING MOTORS

Type RS

Built in two types: Continuous-Duty and Intermittent-Duty, the former further subdivided as constant-speed and adjustable-varying-speed. Built in 1 to 250 horsepower. Described in Bulletin 174, Part 8.

FYNN-WEICHSEL SYNCHRONOUS MOTORS

The motor that corrects power factor while at the same time pulling tough loads. Built in 15 to 200 horsepower. Described in Bulletin 176.

Wagner also builds other types of motors—too many to list here. Ask for the bulletins in the coupon. Standardize on Wagner motors.

Wagner Electric

WAGNER ELECTRIC CORPORATION, St. Louis, Mo.

Please send bulletins checked

- ☐ No. 174 Squirrel-Cage
- ☐ No. 174 Part 8, Slip-Ring
- ☐ No. 176 Fynn-Weichsel

Name _____

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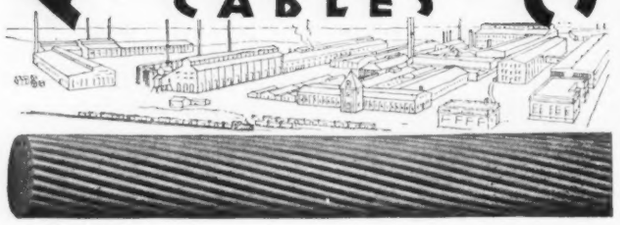

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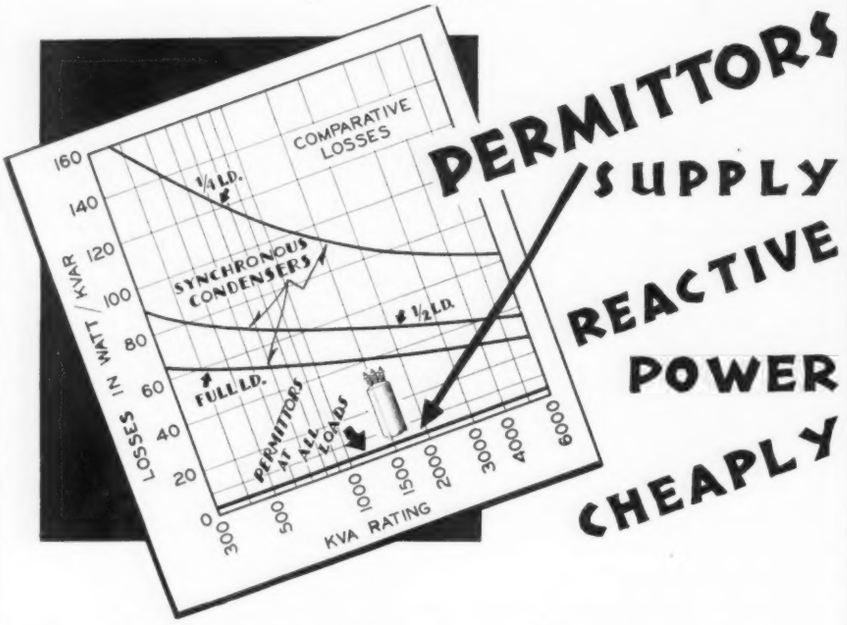

PERMITTORS
SUPPLY REACTIVE POWER CHEAPLY

NOTE the small watt losses per KVA reactive power when Permittors are used. The resulting savings in operating cost are large and are net savings, as the first cost of Permittors and synchronous condensers are practically the same.

Also, consider the additional savings from reduced maintenance and attendance. Operation is greatly simplified and perfectly noiseless.

For full data ask for Bulletin No. 3237.

PRODUCTS PROTECTION CORPORATION
Affiliated with
THE SAFETY CAR HEATING AND LIGHTING CO.
230 Park Avenue, New York, N. Y. — Factory: New Haven, Conn.

PRODUCT INDEX

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AIR-CONDITIONING EQUIPMENT
Frigidaire Corp., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Baldwin-Southwark Corp., Eddystone, Pa.
ALLOYS, RESISTANCE
Driver-Harris Co., Harrison, N. J.
AMMETER, CLIP-ON
Ferranti, Inc., New York, N. Y.
ANALYSES, REVENUE
Recording & Statistical Corp., New York, N. Y.
ANCHORS, GUY
Chance Company, Centralia, Mo.
Everstick Anchor Co., Fairfield, Iowa.
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
APPLIANCES, HEATING
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.
BATTERIES, STORAGE, ALL APPLICATIONS
Electric Storage Battery Co., Phila., Pa.
Gould Storage Battery Co., Depew, N. Y.
BATTERIES, STORAGE, AUTOMOTIVE
Firestone Tire & Rubber Co. Akron, Ohio.
BATTERY CHARGING APPARATUS
General Electric Co., Schenectady, N. Y.
BEARINGS, BALL
New Departure Mfg. Co., Bristol, Conn.
Norma Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Philadelphia, Pa.
BEARINGS, ROLLER
Timken Roller Bearing Co., Canton, Ohio.
BLOCKS, LINEMEN'S CABLE STRINGING
Western Block Co., Lockport, N. Y.
BOILERS, STEAM
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
BOXES, FUSE
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.
BRACES & STRAIN INSULATORS, WOOD
Hubbard & Co., Pittsburgh, Pa.
BRACKETS & WIREHOLDERS, INSULATED
Hubbard & Co., Pittsburgh, Pa.
BRUSHES, CARBON
National Carbon Co., Cleveland, O.
Morganite Brush Co., Long Island City, N. Y.
BURNERS, OIL, GAS, PULVERIZED FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
BUS BAR SUPPORTS
Burndy Engineering Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Schweitzer & Conrad, Inc., Chicago, Ill.
BUS BARS & TUBES
American Brass Co., Waterbury, Conn.
CABLE, ELECTRIC
American Elec'l Works, Phillipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Okonite-Callender Cable Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
United States Rubber Co., New York, N. Y.
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Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.
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General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.
CABLE END BELLS
G & W Elec. Specialty Co., Chicago, Ill.
CABLE FIREPROOFING
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General Electric Co., Schenectady, N. Y.
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I-T-E Circuit Breaker Co., Philadelphia, Pa.
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CIRCUIT BREAKERS, THERMAL
I-T-E Circuit Breaker Co., Philadelphia, Pa.
CLAMPS, CABLE
Brewer-Titchener Corp., Cortland, N. Y.
CLAMPS, GUY
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.